

1
2
3
4
5
6 **FERC Project 184**
7 **Relicensing Environmental Study Requests**
8
9

10
11
12 **Prepared for El Dorado Irrigation District**
13 **September 20, 2001**
14
15
16

17
18
19 Submitted By:
20

	<u>Beginning:</u>	
EIP, Inc.	Line	38
Far Western Anthropological Research Group, Inc.	Line	844
Ecorp Consulting, Inc.	Line	1281

21
22
23
24
25
26
27
28
29
30

31 The following work programs have been submitted to the El Dorado Irrigation District in response to the
32 Request For Proposals (RFP) issued by the District in March 2001. The RFP requested proposals for a
33 number of environmental studies based upon the requests for information submitted to the District and to
34 FERC in regard to the relicensing of Project 184.
35
36
37

**FINAL WORK PROGRAM
FOR
TERRESTRIAL WILDLIFE, BOTANICAL RESOURCES, RECREATION AND AESTHETICS
(FERC Project No. 184 – El Dorado Project)**

Submitted by EIP Associates for Review and Comment September 20, 2001

Introduction

This document describes the status of terrestrial wildlife, botanical resource, aesthetic/visual, and recreation studies requested by the resource agencies and NGOs believed to be necessary to complete the environmental database for the El Dorado Project. For each topic of interest, data collection methodologies are identified and a schedule for field data collection provided for those investigations that are as yet incomplete.

Terrestrial Wildlife

Special-Status Species

In a letter dated 9 July 2001 from Roy Leidy, EIP Associates, to Dawn Lipton, U.S. Forest Service, Stafford Lehr, California Department of Fish and Game, Sharon Stohrer, State Water Resources Control Board, and Gary Taylor, U.S. Fish and Wildlife Service, the following table was presented summarizing the current understanding of terrestrial wildlife investigations for special-status species.

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
INVERTEBRATES				
Button's Sierra sideband (<i>Monadenia mormonum buttoni</i>)	FSC	Yes. Conifer forest/riparian near water	Potentially	No. See narrative following table
Gold Rush hanging fly (<i>Orbittacus obscurus</i>)	FSC	Yes. Conifer forest/riparian	Potentially	No. See narrative following table
South Fork ground beetle (<i>Nebria darlingtoni</i>)	FSC	Yes. Under stones along the margins of cool streams	Potentially	No. See narrative following table
Valley elderberry longhorn beetle (<i>Desmoscerus californicus dimorphus</i>)	FT	No. Riparian with elderberry < 3,000 feet	No suitable habitat within project boundary	No

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
REPTILES AND AMPHIBIANS				
Western spadefoot (<i>Scaphiopus hammondi</i>)	FSC CSC CP	No. Grassland and valley/foot-hill woodlands > 4,000 feet	No suitable habitat within project boundary	No
Mount Lyell salamander (<i>Hydromantes platycephalus</i>)	FSC CSC CP	Yes. Large, rocky outcrops near water sources > 4,000 feet	No. Suitable habitat may occur near reservoirs, but would not be affected by project activities	No
Yosemite toad (<i>Bufo canorus</i>)	FSC EFSS CSC CP	Yes. Wet montane meadows surrounded by conifer forest	No. Suitable habitat may occur near reservoirs, but would not be affected by project activities	No
Northern sagebrush lizard (<i>Sceloporus graciosus graciosus</i>)	FSC	Yes. Montane chaparral, hardwood, and conifer habitats > 3,000 feet	No. Suitable habitat present but not affected by project activities	No
California horned lizard (<i>Phrynosoma coronatum frontale</i>)	FSC CSC CP	No. Valley/foot-hill hardwoods, riparian and grassland with friable soils > 4,000 feet	No suitable habitat within project boundary	No
MAMMALS				
Mule deer (<i>Odocoileus hemionus</i>)	MIS- ENF MIS- TBNF	Yes. Various early to mid-seral habitat types	Potentially	Yes. Need one Fall and Spring migration survey using Trailmasters at 3 canal crossings. Canal fencing status survey also required. Need review of under-crossing designs.

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
Black bear (<i>Ursus americanus</i>)	MIS- ENF MIS- TBNF	Yes. Various habitats	Potentially	No
Sierra Nevada snowshoe hare (<i>Lepus amereicanus tahoensis</i>)	FSC CSC	Yes. Montane riparian thickets mixed with chaparral	No. Suitable habitat may occur near reservoirs, but would not be affected by project activities	No
Nine bat species (various genera)	FSC CSC EFSS TFSS	Yes. Various habitats	Potentially	Yes. Bat surveys completed
Wolverine (<i>Gulo gulo luteus</i>)	CT EFSS TFSS	Yes. Various habitats at high elevation	No. Suitable habitat present but not affected by project activities	No
Fisher (<i>Martes pennanti</i>)	FSC CSC EFSS	Yes. Mature conifer forest with snags and down logs	No. Suitable habitat present but not affected by project activities	No
Pine marten (<i>Martes americana</i>)	EFSS TFSS	Yes. High elevation conifer forests with large down logs	No. Suitable habitat present but not affected by project activities	No
Sierra Nevada red fox (<i>Vulpes vulpes necator</i>)	CT FSC EFSS TFSS	Yes. Forested habitats with openings > 6,000 feet	No. Suitable habitat present but not affected by project activities	No
BIRDS				
American bittern (<i>Botaurus lentiginosus</i>)	FSC	No. Fresh emergent wetlands	No suitable habitat within project boundary	No

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
Mallard (<i>Anas platyrhynchos</i>)	MIS-TBNF	Yes. Various freshwater habitats	No. Suitable habitat present but not affected by project activities	No
Other waterfowl species (various genera)	SIS	Yes. Various freshwater and wetland habitats	No. Suitable habitat present but not affected by project activities	No
Northern goshawk (<i>Accipiter gentilis</i>)	FSC CSC EFSS TFSS MIS-TBNF SIS	Yes. Mature closed canopy conifer forests with open understory	Potentially	Yes. Second year of surveys currently in-progress by EIP
Ferruginous hawk (<i>Buteo regalis</i>)	FSC CSC	No. Open grasslands	No suitable habitat within project boundary	No
Golden eagle (<i>Aquila chrysaetos</i>)	CSC CFP SIS	Yes. Various habitats. Nests on cliffs	No. Suitable habitat present but not affected by project activities	No
Bald eagle (<i>Haliaeetus leucocephalus</i>)	CE CFP MIS-LTP SIS	Yes. Various lake and river habitats with large perch trees	Potentially	Yes. Second year of surveys currently in-progress by EIP
Osprey (<i>Pandion haliaetus</i>)	CSC SIS	Yes. Various lake and river habitats	Potentially	Yes. Surveys currently in-progress at Echo Lake by EIP
Peregrine (<i>Falco peregrinus</i>)	FE CE CFP EFSS MIS-LTB SIS	Yes. Various habitats. Nests on cliffs	Potentially	Yes. Second year of surveys currently in-progress by EIP

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
Blue grouse (<i>Dendragapus obscurus</i>)	MIS-LTB	Yes. Fir and mixed-conifer habitats with open areas	No. Suitable habitat present but not affected by project activities	No
Mountain quail (<i>Callipepla californica</i>)	MIS-ENF	Yes. Grassland, chaparral and forest with shrub understory	No. Suitable habitat present but not affected by project activities	No
Mountain plover (<i>Charadrius montanus</i>)	FC CSC	No. Grasslands < 3,000 feet	No suitable habitat within project boundary	No
Short-eared owl (<i>Asio flammeus</i>)	FSC CSC	No. Winter migrant at lower elevations	No suitable habitat within project boundary	No
Western burrowing owl (<i>Athene cunicularia hypugea</i>)	FSC CSC	No. Open grassland of Central Valley and foothills	No suitable habitat within project boundary	No
Great gray owl (<i>Strix nebulosa</i>)	CE EFSS LFSS	Yes. Mature mixed conifer or red fir forest with large meadows	Potentially	Yes. Surveys to begin in 2002. See narrative following table
California spotted owl (<i>Strix occidentalis occidentalis</i>)	FSC CSC MIS-LTB EFSS LFSS	Yes. Conifer forest habitats > 7,600 feet	Potentially	Yes. Second year of surveys currently in-progress by EIP
Vaux's swift (<i>Chaetura vauxi</i>)	FSC CSC	Yes. Douglas fir forest with snags	No. Suitable habitat present but not affected by project activities	No
Black swift (<i>Cypseloides niger</i>)	FSC CSC	Yes. Moist cliffs	No. Suitable habitat present but not affected by project activities	No

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
Rufous hummingbird (<i>Selasphorus rufus</i>)	FSC	Yes. Open habitat types	No. Suitable habitat present but not affected by project activities	No
Three woodpecker species (various genera)	FSC MIS- LTB	Yes. Various habitats with snags	No. Suitable habitat present but not affected by project activities	No
Willow flycatcher (<i>Empidonax traillii</i>)	CE MIS- LTB EFSS LFSS	Yes. Montane meadows with dense stands of willows and water	Potentially	Yes. First year of surveys currently in-progress by EIP. See narrative following table
Olive-side flycatcher (<i>Contopus cooperi</i>)	FSC	Yes. Conifer forest and woodland habitats with open areas < 9,000 feet	No. Suitable habitat present but not affected by project activities	No
Pacific-slope flycatcher (<i>Empidonax difficillisi</i>)	FSC	Yes. Conifer forest and oak woodland habitats near riparian areas	No. Suitable habitat present but not affected by project activities	No
<u>Federal</u> FE: Listed as Endangered under the federal ESA. FT: Listed as Threatened under the federal ESA. FC: Federal candidate species for listing under the ESA (former C1 designation). FSC: Federal Species of Concern (former C2 designation). EFSS: Forest Service Sensitive Species of the Eldorado National Forest ENF (USFS Species List 10/99). LFSS: Forest Service Sensitive Species of the Lake Tahoe Basin. MIS-ENF: Management Indicator Species as listed in the Eldorado National Forest Land and Resource Management Plan (USFS 1988a). MIS-LTB: Management Indicator Species as listed in the Lake Tahoe Basin Management Unit Land and Resource Management Plan (USFS 1988b). SIS: Special Interest Species as listed by the Tahoe Regional Planning Agency (TRPA) for areas within the Lake Tahoe Basin. Includes Echo Lake for the proposed project.				

Special-Status Terrestrial Wildlife that May Occur in the Project Area and/or be Affected by the Project				
Taxon	Status	Habitat in Project Area?	Habitat Affected?	Field Surveys Required?
<u>State</u> CE: Listed as Endangered under the CESA. CT: Listed as Threatened under the CESA. CSC: California Species of Special Concern. CFP: California Fully Protected Species. CP: California Protected Species.				

To date, no response has been received from the resource agencies indicating that the table does not accurately identify the special-status species of concern, or accurately reflect the agencies' current conclusions as to the need for field surveys for specific taxa. Consequently, *no* specific field surveys have been or will be undertaken for those taxa where potential habitat does occur within the project boundary and "No" is listed in the "Field Surveys Required?" column of the table. As a guiding principal, EID assumes that if potential habitat for a specific taxon occurs within the project boundary, then the special-status species is assumed to be present, whether proven so by field surveys or not. Thus, any future impact assessment on such special-status species will be based on the impact of the project on the *habitat* of that species. No future work is planned by EID relative to the species listed in the table that do not require surveys.

For those species listed in the foregoing table that have potential habitat in the project area and where "Yes" is indicated in the column labeled "Field Surveys Required?," the following status reports are provided.

Mule Deer

Status: The original mule deer investigation conducted by Resource Insights was determined by the resource agencies to be inadequate and incomplete. It will be repeated. All field work remains to be completed following agency approval of the design of the field investigation.

Objective: The mule deer investigation is multi-faceted. The objectives of the investigation are: 1) To document the fall and spring migratory movement of mule deer across the El Dorado Canal; 2) To evaluate that condition and adequacy of deer fencing along the canal; and 3) To evaluated the adequacy of deer undercrossing designs along the canal.

Methodology and Schedule (Objective 1):

Wildlife biologists from EIP Associates in consultation with EID field personnel, and with the assistance of the U.S. Forest Service and California Department of Fish and Game, will in September 2001 conduct one field reconnaissance of the El Dorado Canal for the specific purpose of locating one Trailmaster® camera unit at each of four deer crossings of the canal. The objective of siting the cameras will be to document the movement of mule deer across the canal on the bridges provided for that purpose. Following the selection of the four monitoring sites, EIP will setup and monitor the Trailmasters from 1 October through 31 December 2001, and again from 15 April through 31 May 2002, to document the fall and spring deer migration across the canal. The results of this monitoring program will be reported to each of the resource agencies by 1 July 2002.

Methodology and Schedule (Objectives 2 and 3):

EIP biologists following consultation with the U.S. Forest Service and California Department of Fish and Game will prepare a field data form for evaluating the adequacy and condition of deer fencing and undercrossings along the El Dorado Canal. From this information EIP will create a data dictionary to be used with a GPS unit. Field personnel will walk the length of the El Dorado Canal and record data using both hardcopies and GPS. Photographs will be taken of all locations where fencing or undercrossing are determined to be inadequate. Following field data collection, EIP will prepare a report summarizing the results of the investigation. The GPS data will be downloaded to a GIS program to illustrate the various canal features and the locations where corrective actions may be necessary. EID and the resource agencies will receive copies of this investigation. Weather conditions permitting, the field work for this investigation is proposed to begin by 15 October 2001. The report on the results of the investigation will be issued by 1 May 2002.

Nine Bat Species

Status: Appendix B of Exhibit E (Volume 4) of the *Application for License* for the El Dorado Project lists nine special-status bat species with geographic ranges that include the project area. Of these, six taxa were determined to occur in habitats potentially affected by project operations. These six species are:

- Pallid bat (*Antrozous pallidus*);
- Western red bat (*Lasiurus blossevillii*);
- Small-footed myotis (*Myotis ciliolabrum*);
- Long-eared myotis (*Myotis evotis*);
- Yuma myotis (*Myotis yumanensis*); and
- Townsend's big-eared bat (*Corynorhinus townsendii*).

The U.S. Forest Service specified in its letter of 21 January 2000 that bat surveys needed to be conducted at the Bull Creek tunnel portal, the spoils site (Alder Creek) and at the powerhouse. A site assessment for bat habitat was conducted at the Bull Creek portal in October 1999. The Alder Creek tailings site was surveyed in September, October and November 1999 and again in June 2000. No conclusive results on the occurrence of the six bat species were reached. The results of the bat surveys associated with the Bull Creek Tunnel were reported by Resource Insights in a six-page document dated 23 August 2000 titled *Draft Bat Protection Plan for Amendment to License for Construction of a Tunnel Between Mill Creek and Bull Creek, FERC Project No. 184, El Dorado County, California*. To EID's knowledge, no agency responses to this document were received and no final report has been prepared.

On 22 October 1999, Linda Tatum of the U.S. Forest Service, completed a bat survey of the powerhouse; however, the results of her survey are not in EID's files. Dawn Lipton has agreed to contact Ms. Tatum and retrieve her field notes and any findings she may have reached regarding bat occurrences in the powerhouse area (Lipton, *pers. comm.*, to Leidy, 20 August 2001).

Assuming that Ms. Lipton is able to acquire the bat survey data for the powerhouse area, and assuming that the resource agencies accept the results of that survey as well as the results of the Bull Creek Tunnel surveys, then no additional bat surveys need to be completed for the El Dorado Project. None are proposed.

Schedule:

EIP Associates, in cooperation with the U.S. Forest Service, plans to collect and consolidate all of the bat survey results into a single report for dissemination to the resource agencies and other interested parties. Assuming that the powerhouse bat data are available to EIP by 15 September, then the report would be prepared by 31 October 2001. EID requests that the resource agencies review that draft bat report previously prepared by Resource Insights for its adequacy. Comments and recommendations are requested.

Six Diurnal Birds of Prey (Falconiformes)

Status: Appendix B of Exhibit E (Volume 4) of the *Application for License* for the El Dorado Project lists six diurnal special-status raptors with geographic ranges that include the project area. Of these, only one taxon, the northern goshawk, was found to occur in habitats potentially affected by project operations. Nevertheless, the resource agencies have requested surveys for four of the raptors listed in Appendix B. These four taxa are:

- Northern goshawk (*Accipiter gentilis*);
- Bald eagle (*Haliaeetus leucocephalus*);
- Osprey (*Pandion haliaetus*); and
- Peregrine (*Falco peregrinus*).

Northern goshawk surveys were conducted by KDH Consulting in the Bull Creek Tunnel area on 10 July 2000 and 9 August 2000. In addition, goshawk surveys were conducted in late June 2000 and late July 2000 in suitable habitat surrounding Silver Lake and Caples Lake. The results of the Bull Creek Tunnel surveys were reported in a document titled *Draft Northern Goshawk and Spotted Owl Survey and Recommendation Report for Amendment to License for Construction of a Tunnel Between Mill Creek and Bull Creek, FERC Project No. 184*. A second year of goshawk surveys is currently in-progress in areas of suitable habitat around Silver and Caples lakes.

Six bald eagle surveys were completed in the vicinity of Caples and Silver lakes between 1 July and 30 September 2000. Similar surveys are currently in-progress for 2001.

The Tahoe Basin Management Unit of the U.S. Forest Service monitored osprey occurrences at Fallen Leaf Lake during 2000. EID was requested by the Forest Service to record any osprey observations its field biologists made during the course of the 2001 raptor surveys. These observations are incidental to the raptor surveys currently in-progress. Osprey observations are being recorded for the 2001 field season as requested.

Peregrine surveys were initiated by KDH Consulting in 2000 along the cliff areas of Thunder Mountain near Silver Lake. Two surveys were conducted in May 2000 and two in June 2000. These surveys were repeated pursuant to protocol in 2001.

Methodology and Schedule:

The following field methodologies were employed in completing the diurnal raptor surveys:

- *Survey Protocol for Northern Goshawk on National Forest Lands in the Pacific Southwest Region5: June 1992.* U.S. Forest Service.
- *Draft Bald Eagle Summer Survey Protocol.* U.S. Forest Service.
- *Draft Peregrine Falcon Nesting Survey Protocol.* U.S. Forest Service.

All diurnal raptor surveys will be completed at the end of September 2001. No additional surveys are planned. A report summarizing the results of the two years of raptor surveys will be completed by 31 December 2001.

Two Owl Species (Strigiformes)

Status: Appendix B of Exhibit E (Volume 4) of the *Application for License* for the El Dorado Project lists four special-status owls with geographic ranges that include the project area. Of these, only one taxon, the California spotted owl, was found to occur in habitats potentially affected by project operations. The resource agencies have requested surveys for this nocturnal raptor, and have provided conflicting comments on the need for surveys for the great gray owl.

One daytime and three nighttime surveys for spotted owls were conducted during May through July 2000 in the vicinity of the Bull Creek Tunnel project. In addition, two spotted owl Protected Activity Centers were surveyed (PAC #045 and #214). While no owls were detected in 2000, three additional visits were scheduled for the spring and summer of 2001 in order to comply with the California survey protocol for federal lands. These surveys are completed. The results of the 2000 field seasons were reported in the KDH Consulting document titled *California Spotted Owl, Northern Goshawk, Bald Eagle and Peregrine Falcon Survey Results from the 2000 Field Season*.

Suitable habitat for the great gray owl has been mapped around Silver and Caples lakes. No great gray owls have ever been recorded for El Dorado National Forest or the project area, therefore, no species-specific surveys are proposed. Any impact assessment for this owl will be based on projected impacts to suitable owl habitat.

Methodology and Schedule:

The survey protocol for the California spotted owl is described in the document titled *Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls: 1991 (Revised 17 March 1992)*. U.S. Fish and Wildlife Service. A final report combining the results of the two years of raptor studies for the four special-status species previously discussed (diurnal birds of prey and owls) will be completed by 31 December 2001.

Willow Flycatcher

Status: The U.S. Forest Service has prepared a map of suitable willow flycatcher habitat within a one-half mile radius of all project facilities. A two-year survey following established protocols was initiated in 2001 at the request of the U.S. Forest Service. This work is in-progress by KDH Consulting under the direction of EIP Associates. A second year of surveys will be completed in the spring and summer of 2002.

247 Methodology and Schedule:

248

249 The protocol followed in conducting the willow flycatcher surveys is described in the U.S. Fish and
250 Wildlife Service document titled *A Southwestern Willow Flycatcher Natural History Summary and*
251 *Survey Protocol, May 1997 (Revision 2000)*. Field surveys will be completed by 31 August 2002 and a
252 final report summarizing the two years of data collection will be prepared by 30 September 2002.
253

Botanical Resources

Special-Status Species

Botanical surveys of Project 184, including surveys for special-status plants, were completed by Resource Insights in 1999. The results of these surveys are presented in the document titled *Report of Findings. Project No. 184 Botanical Surveys, Alpine, Amador, and El Dorado Counties, California, October 10, 1999*. This report is included as Appendix N of the *Application For License*. No additional botanical surveys are proposed.

Vegetation Mapping

Resource Insights in cooperation with Price Geographic Consulting completed vegetation maps of Project No. 184 in February 2000. These maps were based on data provided by El Dorado National Forest. The vegetation maps are included as Appendix O of the *Application For License*. No further vegetation mapping is proposed.

Riparian Vegetation

Three draft study plans dated 10 April 2000 were prepared by Resource Insights that addressed riparian vegetation assessments. These studies and their status are:

- *Study Plan for Evaluation of Riparian Herb Communities on Regulated and Unregulated Streams.*
Study completed. No further work required.
- *Plan to Evaluate Project Effects on Recruitment of Riparian Vegetation, Caples Creek.*
Initiated by Donna Lindquist but not completed. A second year of data collection is scheduled for May 2002. A final report will be prepared by 1 August 2002.
- *Study Plan for Monitoring Channels on Sensitive Stream Reaches.*
The monitoring plan which presumably runs the life of the project license has not been implemented. A determination needs to be made as to when the monitoring should commence.

In addition to the foregoing studies, it is EID's understanding that riparian habitat classification and measurement was initiated by Richard Harris of Resource Insights. The exact nature and status of this assessment is unclear to us. EID would like to discuss this investigation with the resource agencies. Any remaining field work will be completed during spring 2002.

Noxious Weeds

The control of noxious weeds was addressed in the document titled *Noxious Weed Control Program* dated 15 August 2000. No additional work is required.

Visual Resources Study Work Plan

Overview

The purpose of the Visual Resources Study is to document the existing visual character of Project 184 and to evaluate the visual effect of continued water delivery operations. No facility modifications are proposed.

Direction for management of visual resources is outlined in the USFS Visual Resources Management System (VMS), which is used to determine the appropriate level of protection for visual resources in any given area and to monitor visual change in the landscape. Although a newer system has been developed (Scenery Management System, 1995), USFS staff have indicated that until the 1988 El Dorado National Forest Land and Resource Management Plan (LRMP) is revised, the 1974 VMS would be the appropriate method for the visual resources assessment.

Methodology

The visual resources study will consist of three parts: A) an inventory and assessment of the Project area's visual resources or landscape character, including a summary of relevant USFS Visual Quality Objectives for Forest Service lands and Tahoe Regional Planning Agency (TRPA) Code of Ordinances, B) an assessment of the visual contrast between the Project's components and the surrounding landscape, and C) a determination of potential measures to reduce this contrast.

For purposes of this study, the Project study area (Study Area) is assumed to include the viewshed at the following locations identified in Section 7.4 of the February 2000 Application for License, Volume 3, Exhibit E: Lake Aloha, Echo Lake and Echo Lake Conduit outlet, Caples Lake, Silver Lake, and the diversion dam on the South Fork of the American River at Kyburz.

A) Visual Resources Inventory And Assessment. The inventory and assessment of the visual resources or landscape character in the Study Area will be applied to all lands within visual range of the Project components listed above. The study will incorporate results from a previous analysis presented in Section 7.4 of the February 2000 Application for License, Volume 3, Exhibit E. This will be accomplished by reviewing existing information for completeness and quality, and by reviewing USFS comments on the existing description of the Study Area to determine where additional investigation is needed. Methods for confirming and/or expanding the existing description of visual resources will include driving the public roads, walking the formal and informal paths on lands open to the public, review of available aerial photographs and maps, and consultation with USFS. The determination of the area's landscape character will be based on the VMS variety classes, sensitivity levels, distance zones, and visual quality objectives, as follows:

1. Variety Classes: The landscape will be surveyed with attention to the landforms, vegetation, rock outcrops, cultural features, and water features. The landscape will then be classified in relative terms as Class A (distinctive and unique), Class B (average or common), or Class C (minimal visual variety).
- 2a. Sensitivity Levels: All travel routes, use areas, and water bodies will be identified as being of either primary or secondary importance within the area of consideration.
- 2b. Distance Zones: This inventory component (a subset of Sensitivity Level) will be a determination of the primary visual distance zones defined as: not seen, foreground, middleground, or background. Foreground will be assumed to range from 0 to 0.5 miles,

350 middleground will extend from the foreground to 3 to 5 miles, and background views will
351 extend from middleground to 15 miles. Unseen areas are assumed to range beyond 15
352 miles or are not seen.

- 353
354 3. Visual Quality Objectives: The applicable USFS objectives for the long-term condition of
355 the landscape character as established by the El Dorado National Forest LRMP and Lake
356 Tahoe Basin Management Unit LRMP will be identified. Some of the Project lands are
357 subject to TRPA Code of Ordinances; applicable aesthetic or visual quality requirements
358 will also be identified.

359
360 B) Visual Assessment. The visual assessment of the Project components and their compatibility with the
361 landscape character of the Project area will be based on views from identified Key Observation Points
362 (KOPs). Individual KOPs will be selected based on the visibility of the Project components from the
363 viewpoint, number of viewers, accessibility of the viewpoint, and typical views of the Project area and
364 Project components. KOPs will be located along traveled routes, and other locations where viewers
365 collect (campgrounds, day use areas, and prime boating/fishing locations). The visual character and
366 visibility of Project features from high public use areas will be photographed. At each KOP, photographs
367 will be taken in different directions into the viewshed, documenting the various landscapes open to
368 viewing from that location. The results will be documented on a map that combines the position of the
369 photo locations and views from each location. GPS coordinates and elevation will also be recorded for
370 each photo station.

371
372 The photographs will be used to describe the extent to which Project facilities are visible from the
373 different locations and whether Project facilities are affecting the landscape character and scenic quality
374 of the viewshed. The Project facilities will then be evaluated to determine the level of compliance of each
375 facility with established objectives, policies, and guidelines. All visual evaluations will be conducted for
376 the summer season, only, due to the relatively limited use of the affected areas in other seasons.

377
378 Project operations effects on visual resources will focus on water-level fluctuations in Project reservoirs,
379 and releases to Horsetail Falls and Echo Creek. "Use" data collected for the recreation studies (e.g.,
380 number of visitors at project recreation facilities and on the water at times of maximum and minimum
381 pool elevations) will be used to assess visual resources associated with reservoir-level fluctuations.
382 Historical releases (quantities and timing) in Echo Creek and Horsetail Falls will be identified to the
383 extent possible give existing hydrologic data and compared with available user data.

384
385 C) Visual Impact Determination And Mitigation Proposals. If Project features are determined to affect the
386 scenic quality, potential mitigation measures will be identified that reduce the contrast between the
387 characteristic landscape and the Project components. Potential mitigation measures may include screening
388 views of the facilities from key viewpoints, planting vegetation to help blend the Project components in
389 with the dominate characteristic landscape colors, or painting to reduce visual contrasts. Except for
390 vegetative screen, these methods rely on reducing the contrast between the Project component and the
391 characteristic landscape. The effects of potential changes in reservoir fluctuations and stream flow
392 releases on visual quality will be assessed qualitatively taking into account user data and data developed
393 as part of recreational analysis to be conducted concurrently with the visual quality study.

394 395 Work Products

396

397 § A report summarizing a) the project area's landscape character in terms of its scenic attractiveness,
398 scenic integrity, absorption capacity, seen areas and distance zones, visual sensitivity, and USFS
399 Visual Quality Objectives; b) the visual contrasts between the Project's components and the
400 surrounding landscape from project KOPs; and c) proposed mitigation measures, where
401 appropriate, to reduce this contrast.

403 § **GIS mapping of key viewsheds.**

405 **Study Schedule**

407 The Visual Quality Study will be completed by September 2002

410 **Recreation**

411
412 *Status:* WRC has reviewed the existing EID recreational resource and user reports and the study methods
413 and data results to determine the applicability of the existing study for in addressing remaining issues. It
414 is our conclusion that the existing material is well structured and suited for describing the present
415 condition of existing recreational resources and facilities and for a general characterization of "typical"
416 recreational users. As a result, following an update rewrite to incorporate additional information already
417 gathered but not yet summarized and a possible expansion to accommodate probable additional USFS
418 information requests using the existing data, it can be used as part of the licensing process for describing
419 existing conditions.

420
421 We find that the short-comings of the existing data and materials are in the areas of its application for
422 developing findings and addressing conclusionary issues such as carrying capacity, relationships of
423 streamflow and reservoir stage to recreational resource values and uses, demand estimation, and
424 alternatives analysis. These are the main points and concerns raised by the USFS. and others.

425
426 These short-comings are not a result of the incomplete status of the studies. They are imbedded in the
427 recreation study approach previously employed, and basic unresolved issues would remain even if these
428 studies were completed. The study approach has relied on questionnaires administered to on-site users at
429 various recreational facilities during one calendar year. Questions essential to carrying capacity, resource
430 preferences, resource values of various streamflow and reservoir stage conditions, and demand etc. were
431 not structurally related to the issues in question, and the method did not provide adequate study control.
432 Therefore, the method would not and will not result in detailed nor defensible conclusions adequate for
433 assigning costs, responsibilities, and licensing obligations. Generally, the important questions were too
434 limited in extent and specificity, unrelated structurally to use levels and resource conditions, administered
435 to a recreation population that does not adequately represent the long-term recreation user universe and
436 can not adequately develop long-term conclusions, too limited in number to adequately represent
437 perceptions of various users groups and activity-types, too limited in time to adequately represent a full
438 user population, and were not administered when the critical issues resources conditions were present
439 (under a range of streamflows and reservoir stages).

440
441 From a review of recreational resources and use sites and a review of the above-mentioned materials,
442 WRC has concluded that a user survey approach to these remaining issues is inappropriate for the Project
443 #184 project. This conclusion is mainly based on the basic Project #184 configuration as a complex of
444 recreation sites with multiple activity-types and low user numbers. The Project is a complex of individual

lakes and stream reaches each with either low levels of dispersed uses (but with diverse user-groups and activity-types), or relatively high levels of use but with a complex and inter-related use mixes in which there is no direct and simple relationship of reservoir stage to suitability for specific activity-types to visitation/demand consequence. An application of a user-survey approach in this setting to sort out the essential resource questions with so many user-groups, activity-types, and resource components would have to be a lengthy and inter-related set of questions and involve a fairly high user population sample proportion. However, even with a better sample instrument and a larger sampling program (with its greater cost), the study approach still has imbedded control limitations that inhibit the defensibility of controversial conclusions.

Objective:

The purpose of the recreation investigations is to document the existing recreational resources of Project 184 and to evaluate any possible effects on recreation caused by potential changes in project operation.

Methodology and Schedule

R4DM Modeling Effort

Given this situation we are proposing an assessment approach to study completion that focuses on the essential outstanding issues and needed conclusions within the framework of WRC's *Regional River/Reservoir Recreation Demand Model* (R4DM). WRC developed the R4DM over the past decade on FERC, Public Trust, and other water resource-related recreation projects to facilitate an efficient and quantifiably defensible method for establishing regional significance and for estimating present recreation demand for complex project operational scenarios and estimating future recreation demand. The Project #184 recreational setting is an ideal application for this model approach.

The R4DM allows for development of demand and visitation estimates on a regional demographic and regional resource-menu basis for a complex of stream reaches and reservoirs inter-related by hydroproject operations. It is a computer-based demand and visitation modeling system with built-in flexibility and capacity to quickly estimate demand for a wide variety of daily and seasonal streamflow and reservoir stage patterns, a variety of regional significance and resource alternative parameters, a wide range of water-year types, and varying hydroproject operational regimes.

The modeling basis for the R4DM can be briefly outlined as:

- \$ define recreation-hydrologic components (stream reaches, lakes, reservoirs, etc.) based on facility configuration, operational patterns, and recreational use (activity-type) patterns, etc.
- \$ for each defined recreation-hydrologic component;
- \$ establish streamflow or reservoir stage relationship to resource values or usability for each activity-type,
- \$ establish inter-relationships between activity-types and influence on visitation,
- \$ establish a carrying capacity conceptual approach and determine range of carrying capacity thresholds for each activity-type user-group,
- \$ establish seasonal (monthly) use and visitation significance of activity-type user-group,
- \$ determine the client region for each activity-type user-group,
- \$ determine regional recreational resource menu for each activity-type user-group,

492 \$ determine potential regional activity-type demand (population, demographics, projected
 493 recreation interests, etc.),
 494 \$ determine modeling wateryear types (and flow and stage time-series),
 495 \$ determine existing and potential future use capacity and availability of regional recreational
 496 resource for each activity-type and user-group,
 497 \$ determine monthly regional significance by wateryear type for the activity-type user-groups, and
 498 finally,
 499 \$ for all recreation-hydrologic components, and
 500 \$ apply to a range of project operational regimes to determine net and gross change in recreation
 501 resource values, use levels, changes in activity-types, present and long-term demand, and regional
 502 significance, etc.
 503

504 An important strength of the R4DM is that it can accommodate and mix a range of information inputs
 505 from detailed and highly structured resource field studies and user surveys to more qualitative information
 506 derived from focus group contributions, professional judgment, user-contact information, key-resource
 507 interviews, and anecdotal input. This makes it an assessment tool well suited to collaborative
 508 development. A second important strength is that the model parameters and coefficients are detailed,
 509 highly compartmentalized, and abstract which makes it difficult to manipulate or to 'game' for strategic
 510 results.
 511

512 Project Induced Recreation

513
 514 WRC has concluded that the user surveys will not be found by the USFS to be adequate nor useful in
 515 determining the project-induced recreation. Additional and more detailed user sampling is not likely to
 516 resolve the issue. The USFS currently does not have a set formulation for determining non-project and
 517 project-induced resource characteristics and recreation uses. EID, USFS, and the recreation consultant
 518 should work together to establish a functional and working definition for non-project and project
 519 conditions.
 520

521 The study approach is as follows:
 522

- 523 • USFS and recreation consultant should characterize resource and site characteristics of Project
 524 #184 recreation-hydrologic components and stream reaches in their non-project configuration.
 525
- 526 • USFS and recreation consultant should identify a suite of recreational resource sites in the Sierra
 527 Nevada that have various site attributes similar to the characteristics developed above.
 528
- 529 • USFS and recreation consultant should use a factor analysis to estimate most likely present level
 530 of recreation facility development, activity patterns, and use levels at the various Project #184
 531 recreation-hydrologic components and related vicinities.
 532
- 533 • This will result in an estimate of use and activities "not related" to Project #184 components (and
 534 vicinities); the difference between that and present project component (and vicinity) uses would
 535 be "project-induced recreation." Given the imprecision of the approach the resulting estimates
 536 should be presented by at least a 10% range of proportion (e.g. 30-40% of the RVDs at Martin
 537 Meadow are project-induced) and any obligations assigned to EID should reflect this level of
 538 precision.
 539

- The estimate of uses not related to the project can be integrated into the R4DM estimates of future demand under various project alternatives for determining future project-induced recreational uses.

Pacific Crest Trail Crossing

The USFS feels this issue can be resolved without further recreation resource study.

Determining Carrying Capacity

WRC has concluded that the user surveys will not be found by the USFS to be adequate nor useful in determining carrying capacities for recreation as there are a very large number of sites and sets of site conditions requiring a very large and well distributed sample size for adequate analysis and the method did not structurally relate crowding responses to actual use levels. Because of these and other imbedded study control problems, additional and more detailed user sampling is not likely to adequately resolve the issue. The USFS currently does not have a conceptual framework nor a set formulation for defining carrying capacity conditions and thresholds within their needs for 4(e) (i.e. “meeting the applicable Forest Plan direction”). [Note: Recent USFS concerns about carrying capacity seem to be limited to facility and social parameters. Earlier USFS concerns included resource condition carrying capacity issues. WRC has limited our discussion here to social and facility issues.]

Social, facility, and physical carrying capacity issues are imbedded parameters of the R4DM for the purposes of setting effective maximum demand and visitation levels prior to user dislocation or discrete shifts in recreational resource values.

The study approach is as follows:

- USFS and recreation consultant should review Forest Plan issues and develop a set of possible conceptual frameworks for defining social and facility carrying capacity.
- Recreation consultant should conduct site visits, conduct informal user interviews, and key-resource interviews to identify on-site attributes that may be functionally significant to recreational users for defining carrying capacity conditions and thresholds.
- USFS and recreation consultant should develop conceptual approach to carrying capacity and develop functional definitions of conditions and thresholds that are both satisfactory to the USFS (for 4(e)) needs and are relevant to the on-site recreational resource circumstances. Preferably a range of carrying capacity conditions and thresholds can be developed which will enhance the USFS’s ability to consider options.
- Recreation consultant should use on-site observation, user-contacts, focus groups, and key-resource interviews to determine the relationships between reservoir stage/streamflow and recreational activity accommodation of these site conditions. This should include observations of use and behavior adjustments to use levels, conflicting activity-types, and on-site space and resource quality.

- Recreation consultant should convert these observations and informational inputs into carrying capacity estimates using the functional definitions developed above. They will vary by streamflow and reservoir stage relations.
- These carrying capacity estimates should be incorporated into the R4DM for recreation demand estimation.

Recreation Facility Conditions: The USFS requests that the Project #184 facilities be inventoried for on-site conditions following a USFS standard facility protocol. The study approach is as follows:

- Recreation Consultant should obtain protocols and execute the inventory.

Operational Efficiency of Recreation Facilities

The USFS reports that this is a non-assessment task requiring recreation facility operators to collaborate on effective and efficient O&M.

Current and Future Demand Studies: WRC has concluded that the user surveys will not be found by the USFS to be adequate nor useful in determining current or future demand as there is no relationship between on-site resource conditions (flow/stage), recreation value, dislocation, and demand/visitation imbedded in the survey. Because of these and other imbedded study control problems, additional and more detailed user sampling is not likely to resolve the issue. We recommend using the R4DM approach for demand estimation following the approach sequence presented in “D” above. The demand estimations result from carrying capacity thresholds (#3), reservoir stage/recreation value relationships (#9), streamflow/recreation value relationships (#11), and regional resource menu and regional demographics (“D”).

The study approach is as follows:

- The recreation consultant should develop “potential future demand” in two stages. First the California SCORP report and the USFS’s RPA regional recreation use and demand trend estimates should be used to develop long-term trends in recreation participation and activity-type preference patterns for the Project #184 client-region. Second the California SCORP report and the USFS’s RPA regional recreation use and demand trend estimates should be modified by applying Project #184 client-region specific future demographics to modify the projected future demand estimates. The Project #184 “client-region” is the visitor source area for users of the project recreation-hydrologic components (see “D”). This should be determined from the existing user surveys and additional user contacts, key-resource interviews, and focus groups, etc.
- The recreation consultant should develop “estimated demand” for each wateryear type for each project alternative (and “not related” to the project uses [see #1]) by using the carrying capacity thresholds (#3) and regional recreational resource alternatives.
- The recreation consultant should develop demand estimated for various project operational scenarios based on five wateryear types. Given the daily range of flows seen on some of the project area hydrographs, for recreation demand purposes it may be most appropriate to represent these wateryear types by considering all the wateryears in categories of wateryear types and reflecting monthly flow and reservoir stage conditions in terms of flow/stage duration or

exceedence for all of the wateryears in the type category. This should be used to characterize long-term present and future demand over various project operational regimes.

Expansion Needs/Needs for New Recreation Facilities

The USFS is looking for a review of present recreational facilities and recommendations for new, improved, or expanded facilities based on facility condition, use levels, and user survey results.

Recreation consultant should review project-induced (#1) recreation sites and support facility size and condition, site use pattern by time-of-day, day-of-week, and season and estimate instantaneous capacity, daily capacity, and seasonal capacity. Resource managers, key-resource interviews, user contacts, and focus groups should be the source of much indirect information on use patterns etc.

For each recreation-hydrologic project component the recreation consultant should categorize inventoried facilities and conditions potentially warranting improvement/expansion by activity-type, potential improvement, and pre- and post-change capacity estimates.

The recreation consultant should develop a list of proposed new, improved, and/or expanded facilities after a project operational regime has been selected, demand (by site and activity-type) has been estimated for that operational regime from the R4DM, an estimation of the proportion of site uses that are project-induced has been estimates, and a review of carrying capacity constraints (#3) has determined potential for unintended conflicts and carrying capacity issues.

Resource Condition and Impacts The studies presented in this package will result in locations, activity-types, use levels, and proportion of uses that are project-induced. The resource impacts associated with these activities should be undertaken within other natural resource-based studies.

Relationship Between Lake Levels and Quality of Experience/Contingent Use Study

The original contingent use and demand study anticipated by EID has not been executed. WRC has concluded that the contingent use study as proposed is ill suited to determining the relative recreation values of varying lake stages and will not relate to future demand (see"C"). We do not recommend proceeding with this approach to resolve the issues. We propose to address this issue through the R4DM and will develop relationships between reservoir stages and activity-type usability, recreation values, inter-relationships between activity-types and site visitation, and monthly significance or sensitivity of the activity-type to various stages. This will be an analogous treatment as for the instream flow studies (#11) within the R4DM and will be used to evaluated project operational scenarios and present and future demand estimates.

The study approach is as follows:

- The recreation consultant should work with the USFS and users (key-resource interview, focus groups, and user contacts, etc.) to develop functional definitions for "optimal" and "reasonable" recreational values.
- As conditions permit there should a careful photo record of lake stages at critical levels, which target recreational use sites and areas.

- Recreational consultant should use on-site reviews, key-resource interview, focus groups, and user contacts to develop a range of reservoir stages that meet the functional definitions for “optimal” and “reasonable” recreational values for each activity-type.
- Recreation consultant should develop relative monthly significance for each activity-type by site from a review of user numbers, user surveys, key-resource interviews, user contact, focus groups, and resource managers.
- The recreation consultant should integrate this information into the R4DM to estimate visitation and demand for various project operational scenarios.

Horsetail Falls Assessment

The USFS is concerned about the application of existing study information to resolving the issue as to the proportion of Twin Bridges/Pyramid Creek users that result from the attraction caused by the visual attributes of modified flows in Horsetail Falls. The resolution of these issues does not involve additional studies but rather requires the development of an analytic structure for the use of existing information such that defensible conclusions can be generated.

The study approach is as follows:

- USFS and the recreation consultant should identify the effective season of site visitation in which the falls would have any attractive draw on users. This should be undertaken by using the use surveys, user contacts, and resource managers.
- USFS and recreation consultant should resolve a flow threshold which can be used reasonably and consistently to separate flow condition that attract users/visits from those that do not. This should be based on existing user data.
- USFS and recreation consultant should resolve the proportion of site visits that are induced when flows are an attractant using the existing site use data and user surveys.
- Recreation consultant should use the flow record to determine the net shift in visitation attraction conditions during the effective visitation season.
- Recreation consultant should estimate net change in site visitation during the effective season for the period of flow records (using present use demand), and net change during the managed recreation season (in which O&M costs are related to site visits).

Recreation Streamflow Studies

This will be an analogous treatment as for the Lake Level and Quality of Experience/Contingent Use Study issue (#9) within R4DM and will be used to evaluate project operational scenarios and present and future demand estimates along stream reaches. See #9 for recommended study approach.

Lake Aloha Recreation-Caused Impacts Study

The USFS reports that it would like an update and replication of the 1994 USFS resource condition inventory of the Lake Aloha area using the same protocols and procedures.

The study approach is as follows:

- Recreation Consultant should obtain existing study and study protocols and execute the conditions inventory.

Finalize Existing User Characterization

While the present discussion of users and facilities etc. is fundamentally complete and usable, we anticipate that there will be a number of USFS clarification requests and requests for new relational results within the user survey materials to address specific questions. A notable task and budget item for completing the recreation portion of the license should include the recreation consultant developing additional assessment, analyses, and write-ups using the user existing user surveys.

Recreation Studies Projected Schedule: Recreation investigations will be completed as follows:

Summer 2001:

- Work with EID and U.S. Forest Service to develop a study approach, detailed work scope, study plan, and expectations;
- Identify and set up focus groups and key resource contacts;
- Work with the U.S. Forest Service, conduct site visits, and develop contacts with users, key resource contacts and others to develop conceptual approach to carrying capacity conditions and thresholds;
- Identify and conduct important late-season dependent field studies (Lake Aloha, etc.) and other late-season activity types and user groups; and
- Initiate discussions with U.S. Forest Service on “project induced” definitions.

Fall 2001:

- Continue important late-season field work as identified;
- Work with the U.S. Forest Service to develop “non-project” site circumstances, site resource conditions, and reasonable non-project recreational development and uses for present regional demand;
- Work with the U.S. Forest Service in reviewing existing user survey data and site descriptions to identify and execute any additional and useful query relationships;
- Initiate focus group process for assisting in study development;
- Set up structure of R4DM recreation-hydrologic components;
- Conduct key resource interviews;
- Conduct Lake Aloha resource condition inventory; and
- Conduct project recreation facility conditions inventory.

Winter 2001-2002

- Continue important winter season field work as identified;
- Work with the U.S. Forest Service and key resource/focus groups to develop functional definitions for carrying capacity conditions and thresholds; and
- Layout summer field season.

Summer 2002

- Conduct field work as prescribed by the work plan and scope;
- Conduct user contacts, key resource interviews and work with the focus groups to advance study program;
- Identify site carrying capacity conditions and thresholds;
- Develop streamflow/reservoir stage relationships to recreation users, resource values, and demand; and
- Develop various elements of the R4DM (regional client area, alternative regional resources, relative seasonal significance, etc.).

Fall 2002

- Complete required field studies;
- Develop construct of the R4DM;
- Obtain five water-year type project operational scenarios;
- Develop demand estimates for the scenarios; and
- Work with the U.S. Forest Service to resolve the outstanding Horsetail Falls issues.
- Develop present and future demand for assumed project operational regime;
- Identify potential new, improved and expanded facilities; and
- Develop Draft Package.

Operations and Maintenance Evaluation

O&M Task 1: Describe Project Operation and Maintenance Procedures

EIP will review all available materials relevant to defining operational and maintenance procedures currently and historically employed for Project 184 hydrologic facilities. Information on road use, maintenance and management also will be reviewed. EIP will meet with EID and Forest Service employees, and others with first hand knowledge of maintenance and management procedures. Based on information gathered from documents and interviews, EIP will prepare a written description of these procedures.

O&M Task 2: Spill Plan Responses

EIP will collect and review any and all available hazardous materials spill prevention and response plans previously prepared for Project 184. EIP will prepare a written description of these plans and evaluate their adequacy in light of current standards and regulations.

O&M Task 3: Description of Geotechnical Conditions and Issues

EIP will collect and review available documentation to describe geotechnical conditions related to Project 184 facilities that concern landslides, debris flows, sedimentation and other geotechnical issues of concern. EIP will prepare a written synopsis of this documentation.

O&M Task 4: Canal Overtopping Frequency and Impacts

EIP will collect and review available historical records and documentation relevant to canal overtopping and will interview current and past Project 184 employees to describe the frequency of past overtopping of Project 184 canal. EIP will then characterize extent of past impacts associated with those overtoppings and present these results in a written technical memorandum to EID.

Meetings and Studies Oversight

EIP will participate in meetings of the Project 184 Settlement Committee as needed. Roy Leidy and/or Rick Hanson will attend up to ten (10) settlement committee meetings when requested to do so by the District or their representative. Mr. Leidy will be responsible for overseeing the performance of technical studies related to terrestrial biological resources so that these studies are performed on time and to the satisfaction of the District. Mr. Hanson will oversee the preparation of studies on visual resources, recreation, and Project operations and maintenance. Mr. Leidy and/or Mr. Hanson will participate in up to ten (10) meetings with EID to address status and administration of the project.

844
845
846
847
848
849

**Scope of Work
for A Cultural Resources Study
of the Proposed FERC Project 184 Relicensing
El Dorado County, California**

850
851

Introduction

852 Section 106 of the National Historic Preservation Act (16 USC 470 and June 1999 amendments) requires
853 that federal agencies consider the potential effects to archaeological, historical, and traditional cultural
854 resources (“historic properties”) from any undertaking on federal lands, or requiring federal permits,
855 funding, or review; and to allow the Advisory Council on Historic Preservation (Advisory Council) a
856 “reasonable opportunity” to comment on the proposed undertaking. Before such effects can be
857 determined, the project Area of Potential Effects (APE) must be defined and inventoried for cultural
858 resources, and any resources found must be evaluated for their scientific, social, and educational values.
859 Only “significant” resources – i.e, those found to be eligible for listing on the National Register of
860 Historic Places – require further treatment. Treatment of significant historic properties usually takes the
861 form of avoidance and protection, or mitigation of unavoidable effects. Determinations of significance,
862 and treatment of historic properties, must be made in consultation with the appropriate Native American
863 community (for ethnohistoric or traditional cultural properties), and must have the concurrence of the
864 State Historic Preservation Officer (SHPO) and the Advisory Council.

865
866 This document proposes a work program and cost estimate for a study of the cultural resources within the
867 APE for the proposed relicensing of the El Dorado Project (FERC Project 184). The study is to be done
868 as part of an environmental assessment for the project, and in compliance with Section 106 and with
869 Section 15064.5(a)(2)-(3) of the California Environmental Quality Act. The proposed study will follow
870 the guidelines for Section 106 compliance outlined in Appendix G of the Federal Energy Regulatory
871 Commission’s (FERC) *Hydroelectric Project Relicensing Handbook* (FERC 1990), and the FERC Office
872 of Pipeline Regulation’s *Guidelines for Reporting on Cultural Resources Investigations* (FERC 1994).

873
874
875

Background

876
877

Status of Previous Work

878 A draft Programmatic Agreement (PA) for treatment of cultural resources within the project area was
879 prepared by David White for Resource Insights, and submitted to FERC. FERC, however, chose to
880 prepare their own, more general draft PA for submission to the Advisory Council. The purpose of the PA
881 is to stipulate to the Council which steps FERC will follow to protect, or mitigate effects to, significant
882 historic properties. The Council subsequently responded that the draft PA is not sufficient, and that
883 additional stipulations are needed. A similar response was made by the Forest Service (Eldorado National
884 Forest), in their review of the draft documents. The Forest Archaeologist for the ENF sees the need for a
885 meeting with SHPO, the Advisory Council, EID, the Forest Service, and perhaps other parties, to discuss
886 the missing elements of the PA (McLemore, personal communication, May 2001). One critical element is
887 the definition of a project APE that is acceptable to all parties. The cultural study proposed here will
888 address issues raised by the U.S. Forest Service regarding the existing draft Programmatic Agreement and
889 Appendix A (discussed below).
890

David White also prepared a draft appendix (Appendix A) for the PA, with summaries of known historic properties within the project APE, discussion of future identification and evaluation of historic and traditional cultural properties, anticipated project effects to these properties, and a management plan for their treatment. The Forest Service considers this document inadequate, for several reasons, including the lack of a defined APE, no discussion of how project effects were determined – particularly the determinations of “no effect” for several of the sites – and insufficient consultation with the Native American community. White also prepared an Ethnographic Overview, which, however, did not include contact with local Native American groups and so is also considered incomplete (McLemore, personal communication, May 2001).

In the fall of 2000, Resource Insights hired Far Western to initiate fieldwork at the high-elevation storage reservoirs. Although the draft PA and Appendix A had not been approved, and no Special Use Permit for the fieldwork had been issued by the Forest Service, it was necessary to inventory the reservoirs while the water levels were at their annual low points. For this reason, the Forest Service agreed to issue Far Western an interim permit, with the understanding that ultimately the full study would require an approved scope of work and a final PA between the Forest Service, SHPO, the Advisory Council, EID, FERC, and the Native American tribes.

Far Western crews surveyed all of Echo Lakes, most of Silver Lake, and a portion of Lake Aloha in October, 2000, before they were driven from the field by blizzard conditions; this represents roughly 35% of the high-elevation reservoir APEs. These interim surveys, reported by Waechter, Nelson, and Berg (2000), identified seven previously unknown sites and 13 isolated finds. The crews also visited 12 previously recorded sites, and re-recorded several of these. Site recordation included the documentation of current and potential impacts to the sites. Nearly 1,100 acres at the reservoirs remain to be surveyed, and many more cultural sites are anticipated.

For the downstream portion of the project area (that is, from the diversion dam to the powerhouse), Resource Insights conducted an archival records search at the North Central Information Center of the California Historical Resources Information System (CHRIS), housed at California State University, Sacramento. From the results of this records search, they concluded that “historic properties have been adequately identified within the lower elevation portions of the APE” (draft Appendix A, no date). In their comments, the Forest Service responded that no agreement has been reached over the adequacy and completeness of survey coverage for the downstream areas. A recent review of the records search documents suggests that there are several areas within the currently-defined FERC APE that have not been surveyed to current standards, and others that have received no coverage, at all. These areas likely will need to be surveyed.

In White’s Appendix A, known historic resources are listed, along with a determination of project effects to each. It is not clear, however, how these determinations were made, or whether SHPO and the Forest Service concur with them. Some resources have already been evaluated for their National Register eligibility; these are listed in Table 1. Those determinations with SHPO concurrence do not need further consideration; those without such concurrence may require additional documentation.

Status of Historic-era Properties Related to the El Dorado Canal (prepared by JRP Historical Consulting Services)

Much of the completed survey work done to record historic-period properties within the FERC relicensing boundary was undertaken prior to 1995. In March 1995, the State Office of Historic

Preservation adopted new methods for recording such properties. These recordation methods are outlined in *Instructions for Recording Historical Resources* (OHP, 1995). One of the innovations adopted in these *Instructions* was the Linear Site Record, a special form used to record cultural resources that tend to have narrow, but lengthy, footprints such as roads, railroad tracks, and canals. These types of resources had long presented cultural resources personnel (whether archaeologists and historians) with a special set of problems because survey of historic properties is usually project-driven. Project APEs rarely include all of the properties associated with a linear resource.

The current FERC relicensing presents the first opportunity to evaluate within a comprehensive survey the El Dorado Hydroelectric Power System and its predecessor, the El Dorado Canal water system, built to serve hydraulic mines in the 19th Century. While the canal itself (i.e., the water-conveyance system

Table 1. Historic resources previously evaluated for their National Register status

State Trinomial (Forest Service No.)	Description	National Register Status	Comments
CA-ELD-511H	Rock walls associated with historic hydroelectric water conveyance system	Eligible	Water conveyance system determined ineligible (lack of integrity) by SHPO
	Project diversion dam	Ineligible; lacks integrity	FEMA, SHPO concurrence
CA-ELD-431H	Rock walls and wooden trestle along Plum Creek	Eligible	Evaluated as part of CA-ELD-511H
(05-03-56-778)	Historic Sad Bridge	Eligible	
(05-03-56-261)	Camp Two (hydroelectric project construction camp)	Eligible	
CA-ELD-691	Lithic scatter at Lake Aloha	Potentially eligible	Deal 1991
CA-ELD-692/H	BRMs, lithic scatter at Lake Aloha	Potentially eligible	Deal 1991
CA-ELD-695H	Rock structure at Lake Aloha	Ineligible; lacks integrity	Deal 1991
CA-ELD-726H	Echo Lake hydroelectric project dam and conduit	Ineligible; lacks integrity	Maniery 1991
CA-ALP-196H State Historic Landmark No. 661	Carson Emigrant Trail and associated features	Eligible	Portions of trail under Caples Lake
CA-AMA-88	Caples Lake hist. resort	Ineligible	Clement 1995

point of diversion on the South Fork of the American River to Forebay) has been systematically recorded and evaluated by Caruso (1990), Shoup (1990) and Glover and Wee (1991), the other elements of the overall project have been recorded and evaluated on a piecemeal basis, leaving some segments unrecorded.

In discussing the El Dorado Canal as an historic resource, SHPO staff has apparently made it clear in deliberations with the Forest Service that it is seeking a comprehensive evaluation of the hydroelectric power system in its broadest context, taking into consideration the overall system – including high-elevation storage reservoirs; diversion works; canal flumes, siphons, pipelines, and other water-conveyance facilities; the powerhouse; and construction, residences, and administrative properties directly connected with the facility. With the exception of certain segments of 1870s rock walls, all other recorded historical resources associated with the canal and hydroelectric power system that have been evaluated for National Register eligibility have been determined *not* eligible for listing in the Register. This factor undoubtedly will strongly influence any conclusions reached with respect to eligibility of the broader system when evaluated in a comprehensive and inclusive context that takes into consideration all of the existing resources related to the project. Nevertheless, this approach appears to be what SHPO is seeking, and JRP proposes to work with that agency to develop the appropriate framework to meet their concerns.

JRP is well-positioned to enter into consultation with SHPO on this issue. It was precisely this type of problem that led Caltrans in 1998 to contract with JRP to prepare a statewide thematic context for historic water conveyance systems in California. That study, published in December 2000 as *Water Conveyance Systems in California: Historic Context Development and Evaluation Procedures*, includes chapters on both mining canals and hydroelectric power systems and sections on how to record and determine the significance of these historic canals within the type of comprehensive framework sought by SHPO. JRP will use this contextual and procedural study together with recordation strategies as outlined in the *Instructions for Recording Historical Resources* to develop a program for recordation and evaluation that meets SHPO standards.

Work Program

This section provides a detailed description of all technical work proposed for Phase I of the cultural study (completion of field inventories, consultation with Native American tribes and State and Federal agencies, and preparation of a technical report). This work will incorporate the data already collected for the project by Resource Insights, and build on those (incomplete) data. Phase I is designed to carry the study forward to the final agreement document between the FERC, Advisory Council, SHPO, U.S. Forest Service, and Indian Tribes, regarding the evaluation of cultural properties subject to impacts (Phase II) and the protection of, or mitigation of effects to, those properties found eligible (Phase III). The attached budget covers Phase I only, as the scope of subsequent phases cannot be determined until the inventories are completed.

Phase I: Consultation and Field Inventory

The first phase of work will include consultation with appropriate agencies and groups, including (but not necessarily limited to) the Forest Service, the SHPO, and local Native American communities. Personnel will include professional archaeologists from Far Western, historian Steve Wee from JRP, ethnographer Penny Rucks, and Gail Thompson, a specialist in cultural

resource compliance for licensing projects (as needed). Some of the tasks outlined here will be done concurrently.

Task 1 – Prepare map of current status of cultural studies

The existing project GIS maps (Price Geographic Consulting 2000) show the results of the Resource Insights records searches, including previous inventories and sites recorded. Far Western's 2000 surveys at the high-elevation storage reservoirs will be added to these. Far Western also will consult with archaeologists on the Eldorado National Forest and the Lake Tahoe Basin Management Unit, regarding any new studies that have been done since the initial records search. Results of these studies, including site locations, also will be added to the project maps.

JRP will assist Far Western in identifying the limits of known historic-era properties within the APE, advise on the adequacy of existing surveys of such properties, and determine those areas which may warrant additional study.

Task 2 – Initiate consultation with the State Historic Preservation Office (SHPO)

Far Western, JRP, and Ms. Rucks, in coordination with the Eldorado National Forest (Forest Archaeologist), will use the maps developed under Task 1 to initiate consultation with the SHPO on the APE for the cultural study, and on the current status of survey coverage and site evaluations. No additional inventory of the downstream portion of the project will begin until the Forest Service and SHPO have approved the APE. (However, the surveys can resume at the high-elevation storage reservoirs [Task 4], under the existing agreement with the Forest Service. These surveys are anticipated for September/early October, when water levels are at their lowest.)

Task 3 – Initiate consultation with the Native American community

This work will be carried out by Ethnographer Penny Rucks, as a subconsultant to Far Western. Ms. Rucks has an excellent, long-standing relationship with the Washoe Tribe, and extensive experience with the U.S. Forest Service and with Native American consultation.

Ms. Rucks will consult with the Forest Service archaeologists to create a list of appropriate Native American contacts; amend the existing Ethnographic Overview (White 1999) to include an ethnohistoric context (including a brief summary of the special case of the Pyramid Lake Paiute water-rights issues); prepare an ethnographic map showing any traditional use areas, place names, tribal government/community associations, the Project APE, and known archaeological resources, for use in Native American consultation; prepare an amendment to the list of traditional place names; and identify which of the Indian communities have a clear relationship to the project APE, and which are clearly outside that APE (some of these include communities listed in Resource Insights' draft Appendix A).

Ms. Rucks also will draft a letter for agency signature, including maps, to initiate contact with the appropriate communities and individuals. Phone calls will be made to follow up on the letter, two weeks after mailing. She will then schedule meetings for exchange of information with Native American groups regarding the project; these meetings may involve resource specialists and representatives of EID to answer project-specific questions and those regarding known resources

1061 in the area. Ms. Rucks will work from these contacts to identify a representative “consultation
1062 committee” to act as primary contacts for consultation for the duration of the project; she will also
1063 identify individuals for focused interviews.

1064
1065
1066 *Task 4 – Complete field inventory and recordation at high-elevation storage reservoirs*
1067

1068 Survey of the remaining 1,078 acres at Lake Aloha, Silver Lake, and Caples Lake, will follow the
1069 same standards and methods used during the 2000 survey (see Waechter et al. 2001). These
1070 methods are taken directly from the *Framework for Archaeological Research and Management*
1071 (FARM; Jackson et al. 1994:Unit I, Vol. A, Ch. 3). All accessible areas will be given complete
1072 coverage, and all cultural sites, features, and isolates will be recorded using the State DPR 523
1073 forms. GPS readings will be taken at site datums and other locations, as appropriate. No artifacts
1074 will be collected. In addition to the new surveys, Far Western will return to unrecorded sites
1075 noted during the 2000 field season, and record these to the same standards described above. All
1076 fieldwork will be carried out by Far Western staff supervisors (M.A. level or higher) and trained
1077 archaeological technicians.

1078
1079 JRP will assist the Far Western crews in recordation of historic-era properties, buildings, and
1080 engineering structures at the reservoirs. These properties most likely will include the following.

1081
1082 *Lake Aloha:* The Lake Aloha Dam (FS 05-03-55-482) was recorded (Deal 1996) but
1083 apparently has not been evaluated. Review of the existing site record on-site and
1084 updating the recordation form would be necessary during Phase I studies, since
1085 evaluation will be necessary in Phase II. Far Western has initiated recordation of the
1086 several auxiliary overflow dams on the lake, JRP will assist in recordation of these
1087 engineering features. JRP assumes that no other historic resources will require
1088 recordation at Lake Aloha.

1089
1090 *Echo Lake:* Maniery (1991) surveyed and evaluated the Echo Lake Dam, the Echo Lake
1091 Chalet and a mini-hydroelectric power plant located near the outlet of the lake and found
1092 all of these resources ineligible for inclusion in the National Register. Recordation and
1093 evaluation on the rock walls that support the pipe conduit downstream from the dam was
1094 deferred pending completion of the historic context for evaluation of rock walls (e. g.,
1095 Wee, 1991) to determine if this engineering feature should be considered a contributing
1096 feature to the discontinuous historic district comprised of significant remaining rock wall
1097 segments constructed during the 1870s as part of the El Dorado hydraulic mining canal
1098 system. Recordation of the rock wall supporting the conduit still needs to be completed.
1099 JRP assumes that no other historic resources will require recordation at Echo Lake.

1100
1101 *Caples Lake:* One of the pioneer emigrant trails over the Sierra Nevada passed through
1102 the Caples Lake region. The site of the trail was recorded by Kenneth Owens (1989).
1103 Sections of State Routes 34 and 88 in the vicinity of Caples Lake have also been recorded
1104 and evaluations may still be in preparation. In addition, some historic structures
1105 associated with dam construction have been recorded (FS 05-03-51-502), but the East
1106 Dam and West Dam at Caples Lake have apparently never been recorded or evaluated.
1107 JRP will record and evaluate these two engineering structures. JRP assumes that no other
1108 historic resources will require recordation at Caples Lake.

1109
1110 *Silver Lake:* Kay’s Silver Lake Resort and the Silver Lake Dam were recorded and
1111 evaluated by Caltrans in 1995 and were determined not eligible for listing in the National

Register. Plasse's Resort, established in 1853 at the south end of Silver Lake, appears to be outside the APE for the FERC relicensing project; therefore, JRP assumes that this resort will not require recordation or evaluation. The highway bridge near Silver Lake Dam was previously evaluated by the Caltrans Bridge Survey (1985) and determined to be a Category 5 Bridge, i.e., not eligible for listing in the National Register at that time. Because the bridge survey is so dated, Caltrans and OHP advise that bridges previously evaluated as Category 5, be revisited to determine whether 1) any new factors might have emerged to change the previous findings; and 2) to re-evaluate the resource if it has become 50 years old since 1985. JRP will perform the necessary research and field recordation in Phase I to determine whether an evaluation of this resource might become necessary in Phase II. JRP assumes that no other historic resources will require recordation at Caples Lake.

Ms. Rucks will conduct interviews and field trips to the project area with Native American groups or individuals, to identify areas of special concern or interest.

Task 5 – Conduct field inventory and recordation of other areas of the project APE, as necessary

Inventory of portions of the downstream APE that have not received complete and adequate surveys in the past will also be covered under this task, to the same methods and standards described above. A cursory review of the original Resource Insights records search maps suggest that as much as 400 acres may remain to be inventoried; however, the documentation obtained from Resource Insights is incomplete in many cases, and so the total acreage cannot be determined at this time. For budgeting purposes, the figure of 400 acres is used. Any unrecorded cultural resources encountered during these surveys will need to be recorded. Our assumption, based on existing surveys in the vicinity, is that 20 cultural sites, isolates, or features will be found within these 400 acres.

Previous inventories within the downstream corridor have documented 21 cultural resources. As noted earlier, seven of these have been determined eligible or potentially eligible for the National Register (refer to Table 1), four have been determined ineligible, and the rest remain unevaluated. For sites which have not been recorded to current FARM standards, it will be necessary to re-record and assess their current conditions. Judging by our experiences at the high-elevation storage reservoirs in 2000, it is likely that some of these sites will not be re-located (either because they were misplotted and are not within the APE, or because they have been destroyed since their initial recordation).

Ms. Rucks will contribute information regarding Native American traditions and oral history associated with this corridor as a component of her field work and interviews.

Task 6 - Documentation of Historic Structures

The following work will be done by JRP Historian Steven Wee, as necessary and appropriate.

Diversion Dam: The diversion dam was destroyed in the 1990s. At that time, SHPO apparently took the position that upon completion of the project to remove the remains of the old diversion dam and construction of a new dam that whatever structure was erected at the historic site of the old dam would require recordation and evaluation. If SHPO still considers this work necessary, JRP will record whatever historic resources currently may exist at the site.

1163
1164 *Water Conveyance System from Diversion Dam to Forebay:* Historic resources related to this
1165 segment of the existing project within the APE have been adequately recorded in all but two
1166 areas: Alder Creek Canyon and Plum Creek Canyon. The most comprehensive recordation of the
1167 water conveyance system was undertaken by Glenn Caruso in 1990, but he recorded only the
1168 “current working water conveyance system.” Subsequent recordation work by Glover (1991)
1169 also focused on the rock walls on the existing PG&E system as it was configured in 1991. Thus,
1170 these studies identified the canal as stretching from the diversion dam on the east to the forebay
1171 of El Dorado Powerhouse on the west. Well before 1990, however, siphons had replaced the old
1172 flumes that once conveyed water at a hydraulic gradient along the steep sides of Alder Creek and
1173 Plum Creek canyons. Neither Caruso, nor Glover, recorded the rock walls that once supported
1174 these flumes with the exception of the east wall in Alder Creek Canyon which supported an
1175 access road to one of PG&E’s ditch tenders cabins in 1990. Subsequently, the rock walls in these
1176 two canyons were identified by Wee (1991) as among the most significant remaining rock wall
1177 segments from the 1870s era canal and were determined as eligible for listing in the National
1178 Register. However, these rock walls have never been formally recorded. Thus, we have the
1179 unusual anomaly of rock walls that are considered eligible for listing in the National Register that
1180 are not adequately recorded. The segments of these rock walls that are closest to the mouth of the
1181 canyons are within the FERC relicensing boundary. To comply with SHPO’s request for a
1182 comprehensive recordation and evaluation of canal related features, these rock walls should be
1183 recorded on DPR 523 Linear Site Records as part of the Phase I study.

1184
1185 *Rock Wall Segments.* The only other segments of the canal that appear to warrant recordation are
1186 the other rock wall segments that were previously determined eligible for listing in the National
1187 Register (Wee, 1991). SHPO often requires consultants performing architectural/historical
1188 surveys to resurvey previously surveyed areas if the prior surveys were undertaken more than five
1189 years ago. This is done to update the current condition of historic buildings and structures to
1190 record physical changes to the property. This resurvey work is frequently required only for those
1191 buildings and structures in a survey area that were determined as eligible for listing in the
1192 National Register or California Register by the previous survey. The other reason to revisit
1193 previously surveyed areas is to determine if any resources have become 50 years old, and
1194 therefore historic period resources, since the previous survey was completed. JRP will review
1195 previously completed field documentation, historic documents and perform necessary field
1196 inventory work, as may be necessary, to determine whether any resources exist on the canal that
1197 have turned 50 years old since the previous surveys were undertaken. JRP expects that this
1198 review will result in minimal new survey requirements. JRP will also revisit those sites
1199 previously determined eligible for listing in the National Register (Flumes 48, 45, 41, 24-25 and 8
1200 and the rock walls in Alder Creek Canyon and Plum Creek Canyon) to determine and record their
1201 current condition. During Phase II work, JRP will use this information to determine whether
1202 current conditions on these canal segments warrant any change in National Register status.

1203
1204 *Forebay to Powerhouse:* This segment of FERC Project 184 has been subject to only minimal
1205 survey for historic resources. Olsen (1969) conducted a cultural resources survey that covered
1206 this entire area in 1969, but he recorded only prehistoric archaeological properties and completely
1207 neglected any historic buildings, structures or potential historic archaeological sites. The only
1208 surveys of historic resources in this area of the project are two in number. First, Maniery (1995)
1209 evaluated selected damaged equipment contained within the powerhouse and a 785’ damaged
1210 section of wood stave pipeline on the conduit between Forebay and the El Dorado Powerhouse.
1211 For reasons that are not entirely clear in her report, she did not evaluate the powerhouse itself or
1212 any other associated resources. Maniery concluded that the equipment and pipe segment
1213 addressed by her report were not eligible historic resources. The only other historic properties to

be recorded and evaluated were three segments of rock retaining wall located on the access road to the powerhouse (Wee, 2001). These rock walls were not considered as eligible for listing in the National Register.

The Forebay, the conduit from the Forebay to the Powerhouse and the powerhouse itself have not been adequately recorded. In addition to these resources on the existing power system, there are the remains of the 1920s construction camp associated with the powerhouse construction and a residential complex where powerhouse operators resided during the era the facility was operated by PG&E. These resources, located across the river opposite the powerhouse and within the FERC relicense boundary, should be recorded in Phase I and evaluated in Phase II.

Other Resources. If any buildings associated with operation and management of the canal or hydroelectric power system are 50 years old and have not been previously evaluated, JRP will record these buildings in Phase I. This work would include any buildings at EID's administrative complex at Ditch Camp 5 that might be 50 years old.

Task 7 – Prepare report documenting methods and results of tasks 1-6

Far Western, JRP, and Penny Rucks will prepare the appropriate report(s) documenting all aspects of the cultural resources studies outlined above. These documents will meet all reporting requirements of the FERC, the Forest Service, and SHPO, sufficient to satisfy the inventory requirements of Section 106. Recommendations will be included for Phase-II (evaluation) and Phase-III (mitigation) work, as appropriate, including an Evaluation Plan for determining the National Register eligibility of any unevaluated resources within the project APE.

Phase II: Resource Evaluations

It is anticipated that a final Programmatic Agreement between FERC, EID, SHPO, the Advisory Council, the Forest Service, and Indian Tribes, will address the management of cultural resources within the project impact areas. In general, those resources subject to on-going or potential effects related to the project, and which have not been evaluated for significance, must be given such evaluation. Resources which are determined not eligible – with concurrence from the SHPO – will need no further management. Eligible properties will require either avoidance, or mitigation of effects (Phase III). It is not possible at this time to estimate the numbers of cultural properties within the project area, or the scope of Phase-II evaluations. However, we can say that sites below the canal along the entire corridor may be in danger from breaches and washouts, while those at the high-elevation reservoirs are subject to erosion, hydrologic sorting, vandalism, and recreation uses. There may also be Traditional Cultural Properties within the APE that will need evaluation.

Phase III: Treatment of Eligible Properties

Appropriate methods of treatment for National Register-eligible properties also will be identified under the Programmatic Agreement. It is anticipated that some properties can be protected from direct or indirect effects related to the project, and appropriate protection measures will be put into place. For other properties, on-going and/or future impacts will be unavoidable. Where this is the case, impacts will be mitigated to the satisfaction of all parties to the PA. Possible mitigation measures may include archival research, HABS/HAER architectural recordation, data-recovery excavations, or public interpretation. It is not possible to estimate at this time the

number of eligible and endangered properties within the project area, or the scope of Phase-III mitigation.

Deliverables

The cultural study will include production of all necessary draft and final inventory reports to satisfy the requirements of FERC, SHPO, and the Forest Service regarding Section 106 compliance. These reports will include methods and results of the studies, and recommendations for any additional work needed; site records on State of California forms (DPR 523); CD-ROM files of digital photographs in .pdf or .tif format; and maps of survey coverage and resource locations. GIS data on resource locations will also be provided, in hand-digitized and/or GPS-based format.

1.0 INTRODUCTION

The El Dorado Irrigation District (EID) has contracted with ECORP Consulting, Inc. (ECORP) to conduct environmental studies in support of its application to the Federal Energy Regulatory Commission (FERC) for Relicensing of the El Dorado Hydroelectric Project, FERC 184-065 (Project 184). ECORP and its designated subcontractors (Entrix, Inc. and Woods Hole Group) have been assigned the following study elements:

- General Fisheries Assessments
 - Fish Population Sampling
 - Fish Entrainment/Passage Assessment
 - Instream Habitat Assessment
 - Population Viability Analysis
- Benthic Macroinvertebrate Sampling
- Amphibian and aquatic reptile surveys
- Water temperature modeling
- Stream geomorphology studies
 - Stream Channel Classification
 - Sediment Management
- IFIM/Habitat Time Series
- Water Quality Assessments
- Bathymetry of Lake Aloha and other project reservoirs.

This Scope of Work has been developed to provide EID with a preliminary project schedule and cost estimate to conduct remaining technical studies. The schedule and cost estimates provided below are to be considered a “first-cut” approximation. After we have had an opportunity to review all available data for specific study elements (e.g., geomorphology) and meet with the CDFG, USFS and other agencies to finalize details of specific study elements, we will refine the Scope, with accompanying costs and detailed schedule. A Cost Summary table is provided at the end of this document. In addition, cost breakdowns for the Fisheries, Benthic Macroinvertebrate Surveys, and Amphibian survey tasks are presented as Attachment A. Cost information is presented (in less detail) in the body of the document for the other study elements.

2.0 GENERAL FISHERIES ASSESSMENTS

Task Start Date

Work began on this task on July 16, 2001.

Delivery Date of Draft Report

We propose a draft report delivery date of October 30, 2003.

Background

The review agencies have indicated that a minimum of three years of data is required to be collected at each of 19 primary electrofishing sites. This task has been completed with the exception of a necessary third year of data collection at Forgotten Flat (Site ID - SV4), Oyster Creek (OY1), and Caples Meadow (CA3). Additionally, three years of fish population sampling is required at each of the seven tributaries that are diverted into the El Dorado Canal. The agencies have indicated that fish populations shall be sampled at two sites in each tributary, upstream and downstream of the diversion, for a total of 14 tributary sampling sites. Tributaries to be sampled include: Carpenter Creek, No-Name Creek, Alder Creek, Mill Creek, Bull Creek, Ogilby Creek, and Esmeralda Creek. Alder Creek has been sampled over three years, however we recommend that it be sampled again for year-specific comparison to the other tributary populations. One hundred meters of stream will be sampled at each site using the 3-pass depletion method.

Fish Population Sampling Protocols

Streamflow data will be collected using standard (i.e., USGS transect methodology) field methods at each stream electrofishing site. Water quality data to be collected include temperature, dissolved oxygen, and conductivity. Dissolved oxygen will be determined with an YSI Model 57 DO meter, and conductivity with an YSI Model 33 S-C-T meter. Instantaneous water and air temperatures will also be measured using pocket thermometers for comparison against meter readings.

Measurements of several physical variables will be collected at each sampling site including, substrate composition, percent instream cover, canopy cover, and habitat composition (percent of area represented by pools, riffles, runs, and cascades). In addition, stream topwidths, with associated water depths, will be measured at 10m intervals throughout each station.

Fish Data

Stream fish sampling will be conducted using two methodologies: backpack electrofishing (multi-pass depletion method) and direct observation (i.e., snorkel surveys). Electrofishing will be the primary collection technique. However, direct observation techniques will be used to augment the fish population estimation program, especially in pools and other habitats that cannot be quantitatively sampled by electrofishing gear.

During sampling, block nets will be placed at the beginning and end of each station to prevent fish movement into or out of the study site during sampling. Fish will be captured during multiple passes (at least three) using Smith Root backpack electroshockers in pulsed DC mode. Additional passes will be conducted, if necessary to minimize population estimation error. The

objective will be to estimate population size by species and lifestage at an error of less than 10 percent. Three electroshockers will be used simultaneously to increase capture efficiency. Captured fish will be held in live cars outside the electrofishing station. After each pass, fish will be processed and placed in a live car. All fish will be redistributed throughout the sampled area after fish collected during the final pass are processed.

The fork length of each fish will be measured to the nearest millimeter. The weight of each fish will be either being measured directly using a portable digital scale, or estimated using the volumetric method. This method entails placing a fish in a graduated cylinder with a known volume of water. One ml of water displaced equals one gram of fish biomass. When large numbers of small, non-salmonids are captured, they will be volumetrically 'weighed' in batches.

Fish scale samples will be collected to characterize the age structure of trout. Scales will be removed from the right side of each fish between the dorsal fin and the lateral line. Scales will be placed in individual envelopes labeled with species, length, weight, capture date, location, and an identification number. All collected fish scales will be read (i.e., "aged") at ECORP laboratories. Back calculation of lengths at age will be performed to estimate and compare growth rates among sites and reaches.

Direct observation (i.e., snorkel surveys) of fish will be conducted in selected pools where electrofishing is unsuitable. Divers will identify and count all observed fish in selected pools. Fish movement into and out of sampling sites will be limited by placement of block nets, if necessary. Two divers will proceed quietly in an upstream direction and count all fish passing beneath them in their respective lanes. To avoid double counts, only fish passing in a downstream direction will be recorded. Divers will carry plastic slates and ordinary lead pencils to record the species and length class of each fish (total lengths noted to the nearest inch). Following each dive, counts from the dive slates will be summed for total fish abundance and size class indexing.

Data Analysis (Population Viability Analysis)

Fish data analysis will include population size estimates by species and lifestage, for each sampling site and reach. Population estimates will be computed using maximum likelihood equations (MICROFISH 3.0, Microfish Interactive Program; Van Deventner and Platts 1986). Length frequency evaluation will be performed by comparing length-frequency histograms with fish scale (i.e., ageing) results. Population viability will be assessed through evaluation of population dynamics, including age structure analysis.

Instream habitat assessment has been completed. No fish passage or entrainment studies are scheduled at this time.

Schedule

Fish population sampling will be conducted during two weeks in the month of October in 2001, 2002, and 2003.

3.0 BENTHIC MACROINVERTEBRATE SURVEYS

Task Start Date

Work began on this task on July 16, 2001.

Delivery Date of Draft Report

We propose a draft report delivery date of March 31, 2002.

Background

The review agencies have stipulated that three years of benthic macroinvertebrate sampling are required at selected primary stream sites and tributaries using the California Department of Fish and Game California Stream Bioassessment Protocols (CSBP). Sampling has been conducted at 30 sites for two years using the approved protocols. One more year of sampling is required. At each location, three riffles will be randomly selected from a field of five identified riffles, and one sample collected from each of the three riffles, for a total of 90 samples.

The California Stream Bioassessment Procedure (CSBP) is a standardized protocol for assessing biological and physical/habitat conditions of wadeable streams in California. The CSBP is a regional adaptation of the national Rapid Bioassessment Protocols outlined by the U.S. Environmental Protection Agency in "Rapid Bioassessment Protocols for use in Streams and Rivers" (EPA 841-D-97-002). The CSBP is a cost-effective tool which utilizes measures of the stream's benthic macroinvertebrate (BMI) community and its physical/habitat characteristics to determine the stream's biological and physical integrity. BMIs can have a diverse community structure with individual species residing within the stream for a period of months to several years. They are also sensitive, in varying degrees, to temperature, dissolved oxygen, sedimentation, scouring, nutrient enrichment and chemical and organic pollution. Biological and physical assessment measures integrate the effects of water quality over time, are sensitive to multiple aspects of water and habitat quality and can provide the public with a familiar expression of ecological health. Anyone who collects fish, amphibians, or invertebrates from the waters of the state must have in their possession a DFG Scientific Collecting Permit.

Point Source Sampling Design

There will be discernable perturbations, impacting structures or discharges into the stream with point sources of pollution. The sampling units will be individual riffles within the affected section of stream and an upstream-unaaffected section. At least one riffle in the unaffected section should be sampled and one or more riffles in the affected section depending on the amount of detail that is required on downstream recovery. The riffles used for sampling BMIs should have relatively similar gradient, substrate and physical/habitat characteristics and quality. One sample will be collected from 3 randomly chosen transects in each riffle. Use the following step-by-step procedures for collecting BMIs using the point source sampling design:

- Step 1 Place the measuring tape along the bank of the entire riffle while being careful not to walk in the stream. Each meter or 3 foot mark represents a possible transect location. Select 3 transects from all possible meter marks along the measuring tape using a random number table. Walk to the lowest transect before proceeding to Step 2.

- 1461 Step 2 Inspect the transect before collecting BMIs by imagining a line going from one
1462 bank to the other, perpendicular to the flow. Choose 3 locations along that line
1463 where you will place your net to collect BMIs. If the substrate is fairly similar
1464 and there is no structure along the transect, the 3 locations will be on the side
1465 margins and the center of the stream. If there is substrate and structure
1466 complexity along the transect, then as much as possible, select the 3 collections
1467 to reflect it.
1468
1469 Step 3 After mentally locating the 3 areas, collect BMIs by placing the D-shaped kick-
1470 net on the substrate and disturbing a 1x2 foot portion of substrate upstream of
1471 the kick-net to approximately 4-6 inches in depth. Pick-up and scrub large
1472 rocks by hand under water in front of the net. Maintain a consistent sampling
1473 effort (approximately 1-3 minutes) at each site. Combine the 3 collections
1474 within the kick-net to make one A composite sample.
1475
1476 Step 4 Place the contents of the kick-net in a standard size 35 sieve (0.5 mm mesh) or
1477 white enameled tray. Remove the larger twigs, leaves and rocks by hand after
1478 carefully inspecting for clinging organisms. If the pan is used, place the
1479 material through the sieve to remove the water before placing the material in
1480 the jar. Place the sampled material and label (see box) in a jar and completely
1481 fill with 95% ethanol. Never fill a jar more than 2/3 full with sampled material
1482 and gently agitate jars that contain primarily mud or sand.
1483
1484 Step 5 Proceeding upstream, repeat Steps 2 through 4 for the next two randomly
1485 chosen transects within the riffle.
1486

1487 *Sampling Design for Assessing Ambient Biological Conditions*

1488

1489 Assessment of ambient biological condition utilizes both the point and non-point source sampling
1490 designs to cover an entire watershed or larger regional area. Ambient bioassessment programs are
1491 used to evaluate the biological and physical integrity of targeted inland surface waters. Stream
1492 reaches should be established in the upper, middle and lower portions of each watershed and
1493 above and below areas of particular interest. Quite often bioassessment is incorporated into an
1494 existing chemical or toxicological sampling design. In most cases, the water quality information
1495 is being collected at a particular point on the stream.
1496

1497 *Measuring Chemical and Physical/Habitat Characteristics*

1498

1499 Measurements of the chemical and physical/habitat characteristics are used to describe the riffle
1500 environment and help the water resource specialist interpret the BMI data. The information can
1501 be used to classify stream reaches and to explain anomalies that might occur in the data. They are
1502 not a good substitute for a quantitative fisheries habitat survey.
1503

- 1504 Step 1 Water temperature, specific conductance, pH and dissolved oxygen should be
1505 measured at the sampling site using approved standardized procedures and
1506 instruments.
1507
1508 Step 2 Record the riffle length determine for the procedure to choose the transect
1509 locations. Estimate the average riffle width by averaging several measurements
1510 along its length. Measure the riffle depth by placing the stadia rod at several
1511 places within the riffle and averaging the measurements.

- 1512
- 1513 Step 3 Estimate or measure the entire length of the reach where the three riffles are
- 1514 chosen as part of the non-point source sampling design.
- 1515
- 1516 Step 4 Measure the riffle velocity using a flow meter placed in front of the three
- 1517 locations along the transect(s) where the BMI samples were collected. Average
- 1518 the readings.
- 1519
- 1520 Step 5 Estimate the percent of the riffle surface that is covered by shade from
- 1521 streamside vegetation (canopy cover) using a densiometer at several places
- 1522 along the riffle and averaging the readings.
- 1523
- 1524 Step 6 Determine substrate complexity and embeddedness by applying Parameters 1
- 1525 and 2, respectively from the Physical/Habitat Quality Form to the riffle where
- 1526 the BMI sample was collected. Use the entire riffle to assess these parameters
- 1527 and make note if the area along the transect(s) is considerably different from
- 1528 the rest of the riffle.
- 1529
- 1530 Step 7 Visually estimate the percent of riffle in each of the following substrate
- 1531 categories: fines (<0.1"), gravel (0.1-2"), cobble (2-10"), boulder (>10") and
- 1532 bedrock (solid). Use the entire riffle to assess this parameter and make note if
- 1533 the area along the transect(s) is considerable different from the rest of the riffle.
- 1534
- 1535 Step 8 Estimate substrate consolidation by kicking the substrate with the heel of your
- 1536 wader boots to note whether it is loosely, moderately or tightly cemented. The
- 1537 estimate should also take into consideration the hands-on experience obtained
- 1538 from collecting the BMI sample.
- 1539
- 1540 Step 9 Measure the gradient or slope of the riffle using a stadia rod and hand level or a
- 1541 clinometer.
- 1542

1543 *Chain of Custody (COC) Form*

1544

1545 The Chain of Custody (COC) form is a necessary part of collecting BMI samples. It is an official

1546 document for tracking the samples from the field to the laboratory and then to their final storage

1547 area. The COC will also provide important information if samples are lost or misplaced.

1548

- 1549 Step 1 At the end of the field day, record the following information on the COC for
- 1550 each group of BMI samples: program name; watershed name; field ID
- 1551 numbers; sampling dates; and name, address, telephone number and signature
- 1552 of one of the crew members collecting the sample.
- 1553
- 1554 Step 2 Field samples and COCs must remain in a locked sample depository until a
- 1555 decision has been made to send them to a bioassessment laboratory for
- 1556 processing.
- 1557
- 1558 Step 3 When transporting to a bioassessment laboratory, each group of samples must
- 1559 be accompanied by a COC. Upon delivery, a Bioassessment Laboratory
- 1560 Number will be assigned to each sample. Record this number on the COC and
- 1561 each individual CBW along with the name and address of the bioassessment
- 1562 laboratory. When all samples listed on the COC are accounted for, then the

individual delivering the samples will sign the "Released By" portion and the laboratory personnel will sign the "Received By" portion of the COC. The original COC will remain at the laboratory and the project supervisor will retain a copy.

Professional (Level 3) Laboratory Procedures

The CSBP has three levels of BMI identification. Level 3 is the professional level equivalent and requires identification of BMIs to a standard level of taxonomy, usually to genus and/or species level. All professional Bioassessment Laboratories (As is ECORP Consulting, Inc.) should belong to the California Bioassessment Laboratories Network (CAMLnet). This organization was conceived to provide technical assistance to laboratories and ensure that laboratory efforts are consistent throughout California.

Subsampling

Step 1 Retrieve the sample from the sample depository and cross-check the sample number with the bioassessment laboratory number on the COC.

Step 2 Empty the contents of the sample jar into the # 35 sieve (0.5 mm mesh) and thoroughly rinse with water.

Step 3 Once the sample is rinsed, clean and remove debris larger than 2 inch. Remove and discard green leaves, twigs and rocks. Do not remove filamentous algae and skeletonized leaves.

Step 4 After cleaning, place the material into a plastic tray marked with equally sized, numbered grids (approximately 2x2 inches). Do not allow any excess water into the tray. Spread the moist, cleaned debris on the bottom of the tray using as many grids necessary to obtain an approximate thickness of 2 inch. Make an effort to distribute the material as evenly as possible.

Step 5 Remove and count macroinvertebrates from randomly chosen grids until 300 BMIs are removed. Place the BMIs in a clean petri dish containing 70% ethanol/5% glycerin. Completely count the remaining organisms in the last grid but do not include them with the 300 used for identification. The final count should be recorded on the benchsheet for eventual abundance calculations.

Step 6 The debris from processed grids should be put in a clean Aremnant@ jar and the remaining contents of the tray should be placed back into the original sample jar. Both jars should be filled with fresh 70% ethanol, labeled (bioassessment laboratory number and either Aoriginal@ or Aremnant@) and returned to the sample depository.

Identification of BMIs

Step 7 Identify the 300 BMIs from each sample to the standardized level recommended by CAMLnet using appropriate taxonomic keys.

Step 8 Place identified BMIs in individual glass vials for each taxon. Each vial should contain a label with taxonomic name, bioassessment laboratory number,

stream, county, collection date and collector's name. This voucher collection should be labeled and returned to the Sample Depository.

Step 9 Record taxonomic information on a Macroinvertebrate Laboratory Bench Sheet. The bench sheet should include the following information: watershed or project name; sampling date; sample ID number; bioassessment laboratory number; date of subsampling; name of subsampler; remnant jar number; taxonomy completion date; name of taxonomist; taxonomic list of organism and enumeration; total number of organisms; total number of taxa; list of unknowns, problem groups and comments.

Step 10 Maintain a reference collection of representative specimens of all accurately identified BMI taxa.

Taxonomic Identification and Enumeration

The CSBP requires that all organisms are identified to a standardized taxonomic level using established taxonomic keys and references. The QA Taxonomist should check at least 10% of the samples for taxonomic accuracy and enumeration of individuals within each taxon. The same sample numbers that were selected randomly for the subsampling quality control should be used for this procedure.

Bioassessment Validation

The CSBP recommends at least 20% bioassessment validation where whole samples of 300 identified BMIs are randomly selected from all samples either for a particular project or for all samples processed within a set time period such as each 6 months or a year. The labels should be removed from the vials and replaced with a coded label that does not show the taxonomic name of the BMIs. The validation laboratory or specialist should be instructed to identify and enumerate all specimens in each vial and produce a taxonomic list. There will inevitably be some disagreements between the bioassessment and the external laboratory on taxonomic identification. These taxa will be re-examined by both parties and a resolution reached before a final QA report is written.

Data Development and Analysis

The CSBP analysis procedures are based on the EPA's multi-metric approach to bioassessment data analysis. The EPA is developing procedures for multi-variate analysis of bioassessment data, but that method is not presented here. However, the sampling protocols presented in this document were designed to facilitate the use of multi-variate analysis and more information will be presented when standardizes techniques for California become available. A taxonomic list of the BMIs identified for each sample will be generated for each project along with a table of sample values and means for the biological metrics listed on the last page of this document. Variability of the sample values should be expressed as the coefficient of variability (CV). Significance testing can be use for point source sampling programs and ranking procedures can be used to compare sites.

Schedule

Field sampling will be conducted during three weeks in the months of October and November, 2001. Benthic samples from the previously collected samples (year 2000) and 2001

4.0 AMPHIBIANS AND AQUATIC REPTILES

Task Start Date

Preliminary work on this task began on July 16, 2001.

Delivery Date of Draft Report

We propose a draft survey proposal report delivery date of December 15, 2001 and a draft survey report by September 15, 2002.

Background

Amphibian monitoring will be implemented to: identify areas of potential habitat for foothill yellow-legged frog (FYLF), mountain yellow-legged frog (MYLF), and California red-legged frog (CRLF); to determine the presence, location, and distribution of these species; determine the seasonal timing of breeding and larval periods; collect microhabitat utilization information; and assess identified populations relative to changes in the streamflow regime.

Determining the presence, distribution, and breeding and larval periods of special-status amphibians is necessary to evaluate potential impacts resulting from streamflow modifications (particularly short-term modifications). Monitoring FYLF, MYLF, and CRLF in 2001 and especially 2002 will provide baseline conditions prior to the initial stages of streamflow modifications and will set the basis for the evaluating project alternatives.

A specific example protocol for conducting amphibian monitoring, in this case for the Mokelumne River, is presented as Attachment B. We will modify this protocol as needed (and as directed by the CDFG/USFWS and the USFS) for use in the Project 184 survey locations. California RLF protocols are Attachment C.

Year 2001

We will review color aerial photography of the project area, focusing on potentially affected areas, to identify areas that provide suitable habitat for special-status amphibian species.

Areas of potential habitat will be identified and stratified by target species (especially California red-legged frog, foothill yellow-legged frog, and mountain yellow-legged frog).

Reconnaissance-level field surveys will be conducted to assess and groundtruth general habitat conditions and prioritize in-depth survey locations. Surveys will follow established PG&E methods and protocols and will involve informal consultation with USFWS, CDFG and USFS. A survey proposal will be developed and submitted to resource agencies for approval/consensus in November of 2000.

Year 2002

The agency-approved amphibian survey program will be implemented from May through October. The draft report summarizing survey results, including appropriate graphics, maps and recommendations will be prepared in November/December and submitted to EID and resource agencies for review. The cost of the actual survey program will be determined following the resource agency approval of a final survey proposal.

Survey Protocol For Foothill Yellow-Legged Frog

The survey protocols described in this document are designed to determine the presence, distribution, and relative abundance of foothill yellow-legged frog (*Rana boylei*). Sites where surveys will be conducted have been selected based on information obtained through the results of preliminary habitat assessments in the watershed. The selected sites represent locations where moderate to high quality habitat is present based on species-specific habitat criteria. Visual encounter surveys (VES) will be conducted at each site. Separate approaches will be used for river sites (i.e., sites on main stem project-affected river reaches) and for tributary stream sites (i.e., tributaries to project-affected river reaches and project reservoirs). VES at river sites will follow a modified approach from Lind (1997). The survey methods for tributary streams are based on Crump and Scott (in Heyer et al., 1994). Detailed site habitat assessments will be conducted at each site following the initial VES. Unless there is a significant change in habitat during the survey period (e.g., significant increases or decreases in flow), site habitat assessments need only be completed once. General survey protocols are described in the following paragraphs.

General Information

VES for foothill yellow-legged frog will be conducted at the appropriate periods to detect specific life stages. Surveys at river sites will include all life stages. One to two VES to identify breeding and/or oviposition will be conducted between March and June. If during the initial breeding survey, no egg masses are documented at a given site, a second survey will be conducted two to four weeks later. Subsequent to the breeding survey(s), a tadpole survey to determine the presence and distribution of larvae will be conducted approximately two to six weeks after the last breeding survey. Finally, a juvenile/adult survey will be conducted between July and September. The actual timing of these surveys will be based largely on seasonal weather conditions and river outflows. Surveys on tributary streams will be conducted once during the summer and will focus on tadpoles and/or frogs.

The following methodologies are designed for two individuals surveying together. At river sites, it may be possible for the two individuals to separate and survey different areas at the same time. However, it is important to clearly define the boundaries of the search areas to avoid disturbing amphibians that may be present in adjacent areas. The survey method chosen at a site should be recorded on the VES data sheet. At tributary sites, surveyors should search in tandem.

If available, copies of aerial photographs should be used to denote site boundaries, search pattern, and prominent habitat features. If aerial photographs are not available, drawings of the survey site should be included on the back of the site habitat assessment data sheet. The exact location of egg masses, tadpoles, and frogs should be included on the photos and/or drawing. Photographs of the site should be taken to supplement aerial photos or site drawings. A hip chain, tape, or range finder may be used to determine the length of all linear aquatic habitat surveyed.

At all sites, surveyors will record the total area surveyed (length x width) and total survey effort (time spent surveying x number of surveyors). At river sites, all observations of egg masses, tadpoles, and frogs will be recorded on the river VES data sheets. On tributary streams, all observations of tadpoles and frogs will be recorded on the tributary VES data sheets. Separate data sheets are included for each life stage. At all sites, habitat parameters will be measured or estimated and then recorded on the site habitat assessment data sheet.

- Surveys along rivers will be focused at specific river locations. The length of each site will vary depending on the amount and type of suitable habitat available. The survey area will include all suitable habitats that can be surveyed within approximately 2 hours (2-hours per surveyor). In all cases, the same search area should be surveyed during each site visit. The time required to complete the habitat assessment data sheets will not be included in the survey effort. The specific survey methodologies to be used at river sites are described in Section 1.
- Surveys along unregulated tributary streams will extend from the mouth or confluence with project reservoirs and/or rivers upstream a maximum of ½ mile, if there is suitable habitat. The specific survey methodologies to be used for tributary streams are described in Section 2.
- Surveys along regulated tributary streams should include the entire affected reach, if applicable.

Survey Methodologies

- River Surveys – The survey methods described below are based on information provided in:
Lind, Amy. 1997. Survey Protocol for Foothill Yellow-Legged Frogs (*Rana boylei*) in Streams. USDA Forest Service, Pacific Southwest Research Station, Arcata, CA. DG: S27L01A.

Visual Encounter Survey for Egg Masses, Tadpoles, and Frogs

Surveys at river sites should be conducted using two surveyors. Depending on the conditions at the site, surveyors may work in tandem or individually, as described in Section 1b, below.

- 1a. Establishing site boundaries – Initially, the entire site (including both banks if there is suitable habitat) will be surveyed by walking along the shoreline to document distribution of habitat, and to record presence of egg masses, tadpoles, and frogs. After surveying the entire site, the upstream and downstream ends will be flagged with semi-permanent markers. If there is extensive habitat at a site that cannot be surveyed within the 2-hour time period, surveyors will establish subsites. Subsites should be preferentially established in habitats where amphibians are observed. If amphibians are not observed, subsites should be selected based on presence of suitable habitat (e.g., gravel/cobble bars, boulder/sedge habitat, etc.). The upstream and downstream boundaries of each subsite will be flagged. Separate “site habitat assessment data sheets” will be completed for each subsite. If egg masses and tadpoles are observed within a site/subsite, their exact location will be marked with an aluminum tag. One tag should be used for egg masses or tadpoles that are observed in groups. These

1808 markers will be used on subsequent visits for monitoring changes to egg masses
1809 and tadpoles.

1810
1811 The area surveyed at each subsite will be based on the amount of suitable habitat
1812 present. Surveys should begin at the river bank shoreline. Surveyors should
1813 search the bank and adjacent aquatic habitat first to avoid stepping on eggs or
1814 tadpoles that may be present along the river margin. After completing these
1815 observations, surveyors may sample suitable aquatic habitat away from the river.

- 1816
1817 1b. General survey methods – Depending on the conditions at the site, surveyors may
1818 work in tandem or individually.

1819
1820 *Tandem surveys*

1821
1822 If the river is too wide to cover adequately with one surveyor on each bank (e.g., the two banks
1823 are too far apart for each individual to adequately observe amphibians on their bank as well as on
1824 the opposite bank) surveyors should remain together. When surveying together, the individual
1825 that is searching for adult and juvenile frogs should walk ahead of the individual sampling for
1826 eggs and tadpoles. The lead surveyor should first use binoculars to scan the bank and other
1827 exposed substrate, including the adjacent aquatic habitat for adult and juvenile frogs. The
1828 individual searching for egg masses and tadpoles should follow behind randomly dip netting
1829 pools and other appropriate habitat for tadpoles. The use of a mask and snorkel or plexiglass
1830 viewing box may be helpful in searching for eggs and tadpoles. When a survey is completed on
1831 one bank, the surveyors should repeat the survey on the opposite bank if appropriate habitat is
1832 present.

1833
1834 *Individual surveys*

1835
1836 When one individual is surveying one bank of a river, all search parameters (i.e., using binoculars
1837 to look ahead for frogs, searching for egg masses and tadpoles, etc.) are conducted by the one
1838 surveyor. It is important to clearly define the boundaries of the areas to be surveyed by each
1839 individual to avoid sampling the same habitat, and to minimize disturbance to amphibians in
1840 adjacent areas. Flagging should be used to indicate where individuals begin searching to avoid
1841 overlap.

1842
1843 Initially, binoculars should be used to scan the bank, exposed substrate, and the adjacent aquatic
1844 habitat for adult and juvenile frogs. The surveyor then searches for egg masses and tadpoles in
1845 suitable habitat (river margins, pools, etc.). In deep water, the use of a mask and snorkel or
1846 plexiglass viewing box may be helpful in searching for eggs and tadpoles. Dip netting should be
1847 conducted periodically to aid in detecting tadpoles.

- 1848
1849 2. Tributary Stream Surveys - The survey methods described below are based on
1850 information provided in:
1851 Crump, M.L. and N.J. Scott, Jr. 1994. *Visual Encounter Surveys*. Pages 84-92 in
1852 W.R. Heyer, M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster,
1853 eds. *Measuring and Monitoring Biological Diversity: Standard Methods for*
1854 *Amphibians*.

1856 *Visual Encounter Survey For Tadpoles and Frogs*

1857
1858 Surveys along tributary streams should be conducted using two surveyors working in tandem.
1859 Surveys will extend from the mouth or confluence with project reservoirs and/or rivers upstream
1860 a maximum of ½ mile, if there is suitable habitat. The individual that is searching for adult and
1861 juvenile frogs should walk ahead of the individual sampling for tadpoles. The lead surveyor
1862 should first use binoculars to scan the bank and other exposed substrate, including the adjacent
1863 aquatic habitat for adult and juvenile frogs. The individual searching for tadpoles should follow
1864 behind randomly sampling pools and other appropriate habitat for tadpoles. In deep water, the
1865 use of a mask and snorkel or Plexiglas viewing box may be helpful in searching for tadpoles. A
1866 hip chain, tape, or rangefinder should be used to determine the length of the tributary stream
1867 surveyed.

1868
1869 If available, copies of aerial photographs should be used to denote site boundaries, search pattern,
1870 and prominent habitat features. If aerial photographs are not available, drawings of the survey
1871 site should be included on the back of the habitat assessment data sheet.

1872
1873 The location of tadpoles and frogs should be included on the photos and/or drawing. Photographs
1874 of the site should be taken to supplement aerial photos or site drawings. A hip chain, tape, or
1875 range finder may be used to determine the length of all linear aquatic habitat surveyed. At all
1876 sites, surveyors will record the total area surveyed (length x width) and total survey effort (time
1877 spent surveying x number of surveyors). All observations of tadpoles and frogs will be recorded
1878 on the tributary VES data sheets. A separate data sheet is included for each life stage. At each
1879 site habitat parameters will be measured or estimated and then recorded on the site habitat
1880 assessment data sheet. For tributary streams, only one site habitat assessment data sheet is
1881 required.

5.0 GEOMORPHOLOGY

Task Start Date

Work began on this task on July 16, 2001.

Delivery Date of Draft Report

We propose a draft report delivery date of February 15, 2002. The field notes from the Rosgen Level III surveys performed in 2000 are not complete, requiring additional field surveys in 2001. For example, level II analyses appear to be incomplete, including:

- Cross section surveys,
- Particle size analysis (e.g., pebble counts),
- Longitudinal profiling,
- Sinuosity assessment.

The draft report delivery date will be December 15, 2002.

Background

EID has been directed to perform a Rosgen Level III geomorphology assessment by the review agencies, in particular, the USFS. For the purpose of determining scheduling and costs, we assume that the Level III assessment would need to be performed in only those project areas that are considered to be sensitive to project operations. These areas would most likely be the channel reaches that have been previously identified as Rosgen E and C type channels. It is possible that other channel types could be important for a Level III assessment, but that would have to be determined in consultation with the USFS. We do not know at this time how many miles of stream channel have been identified as C or E type channels, however we have assumed that we would need to survey about 10 miles of channel for the level III evaluation. We are also assuming that the Level I and Level II data and results collected by Doug Parkenson will be available for our review prior to performing a Level III assessment.

Schedule

Work will be initiated in early September with a review of the aerial photography and available information reports that are relevant to the geomorphology and hydrology of the project streams. We will then meet with the USFS to discuss our approach. Following that meeting, we will prepare a Geomorphology Study Plan for review and comment by EID and the appropriate agencies, such as the USFS. Once the Study Plan has been accepted, fieldwork will be initiated.

An initial reconnaissance level survey to inspect geomorphic conditions along the project affected streams and to verify the sampling locations that were used for the Rosgen Level II assessment will be conducted. Doug Parkenson will provide valuable assistance for this portion of the fieldwork since he participated in the Rosgen Level I and Level II surveys. The Level III field data collection will follow this step, occurring during the month of November/December. We will reduce the field data in December, with preparation of a draft report mid-February. The schedule for each of the major work steps are listed below:

<i>Date</i>	<i>Task</i>
Oct. 1- 5	Meet with USFS, collect and review relevant existing data
Oct. 8-12	Prepare Geomorphology Study Plan
Oct. 15-19	Revise Study Plan based on USFS and Agency Comments
Oct. 22-26	Field reconnaissance inspection of project stream reaches with assistance from Doug Parkenson to verify Level II sampling sites
Oct. 29 - Nov. 24	Conduct field work for Level III assessment
Dec. 1-21	Reduce and evaluate data
Jan. - Feb. 15	Prepare draft report

If geomorphic studies other than the Level III assessment are determined to be required in consultation with the USFS (e.g., Sediment Management), then it will likely be necessary to conduct those studies commencing in spring and summer of 2002.

6.0 IFIM/Temperature Modeling & Water Quality/Hydrology

Proposed Scope of Work for these tasks have not been fully developed due to the tiered nature of these studies. Although a data review has been completed, we require additional agency input to complete the proposal. For example, the USFS has not yet completed its review of the IFIM studies, and we are not aware of further requirements. Temperature modeling is dependent on review of the entire dataset and on agency input of that review. For the purpose of this Scope of Work and Cost Proposal, we provide our best available estimates, given that the final scope is not yet complete.

IFIM/PHABSIM

The Scope of Work for the IFIM task is dependent on the results of the agency review. We assume that the original IFIM model will be accepted by the agencies, with contingency set aside for performing additional modeling. We anticipate that additional modeling will include Habitat Time Series modeling. Physical Habitat Simulation Modeling (PHABSIM), the assessment of the relationship between stream discharge and aquatic habitat, has largely been completed. Entrix Inc., as a subcontractor to ECORP, will evaluate past study effort and provide the lead for addressing the following issues:

- effects of diverting varying quantities of water on aquatic resources,
- habitat requirements of existing aquatic resources,
- effects of project discharges on stream morphology and stability,
- development of measures for protection of aquatic resources,
- develop recommendations in consultation with appropriate resource agencies for instream flow requirements and flow regimes that will meet identified protection measures.

Water Temperature Modeling

Agencies are interested in evaluating project operation alternatives for improvement in water temperature and other water quality parameters in potentially-affected reaches. Water temperature modeling of the entire stream network affected by project operations will be conducted using the Stream Network Temperature (SNTEMP). Mr. Kenneth Voos, who was instrumental in development of SNTEMP, will lead this effort.

1979

1980 The Temperature Modeling task is also dependent on additional agency input. We assume that
1981 we will use the original model as a basis for network model development. Concerns with the
1982 original model centered on unacceptable flow simulations at specific project stream reaches.
1983 With the installation of flow and water temperature measuring units at all study reaches, real data
1984 can be used to input the temperature model. The scope of work will focus on analysis of all flow
1985 and temperature data, performance of additional flow simulations for tributaries, shade modeling
1986 over the entire study reach, analysis of meteorological data, and analysis of reservoir water
1987 temperature input data.

1988

1989 **Water Quality and Hydrology**

1990

1991 Hydrology and Water Quality scope includes assessment of the 35 year water record and
1992 identifying water year types, collaboration with Harold Meyers on a limited basis for
1993 development of input for the Oasis Model, and limited development of specific hydrologic units
1994 (e.g., selected tributaries).

1995

7.0 BATHYMETRY

We provide more in depth information for the bathymetry task because it is essentially new information to EID and the study team. Introductory materials (not presented for other tasks) are presented for an environmental setting.

Bathymetric survey information is required at each of the project reservoirs, in part to assess sediment accumulation and its effect on storage capacity. Bathymetric surveys were performed during 1999 for EID to describe physical project reservoir characteristics of Silver, Caples, Echo and Forebay reservoirs. Bathymetric and topographic surveys of Aloha Lake will complete the characterization of the project reservoirs for EID. Woods Hole Group (WHG) is acting under contract to ECORP to assist EID in Relicensing efforts for Project 184. WHG will employ David Evans and Associates (DEA) and Hunter Survey Inc. (HSI) for the bathymetric and topographic survey elements respectively.

Lake Aloha, located in the Desolation Valley, has about 10,000 acre-feet capacity. Lake Aloha is contained by a main dam of rubble and masonry construction on Pyramid Creek, with a maximum height of 33 feet above streambed and crest length of 113 feet. The reservoir is further formed. There are eleven auxiliary dams helping to contain the lake by flooding Medley Lakes, ranging between 1.25 feet and 8.5 feet in height to the crest and between 9 feet and 140 feet in length. At last calculation, the reservoir had an area of 630 acres and a gross storage capacity of 5,280 acre-feet.

The lake is located within the Desolation Wilderness. The wilderness contains 63,475 acres of sub-alpine forests, granite peaks; and glacial lakes and valleys. The El Dorado National Forest administers a total of 42,194 acres of Desolation Wilderness, and the Lake Tahoe Basin Management Unit administers 21,281 acres.

The area is accessible year round and is one of California's most popular hiking areas because of its proximity to large urban areas (Sacramento and San Francisco Bay area). Ease of access via major highways and thirteen convenient trailheads, and the influence of the Lake Tahoe Basin and Crystal Basin recreation areas make it a high impact visitor area from spring through fall.

The USFS will not permit any gasoline-powered equipment to be brought into the area without prior, written authorization. In addition, the USFS will not allow mechanized equipment (i.e. helicopter, trucks, etc.) to be used to transport equipment into Desolation Wilderness. The USFS does approve campsites, as long as all human waste is buried and all other garbage is packed out. Campfires are prohibited and dogs are not allowed.

Bathymetric and topographic mapping of Aloha Lake will be conducted to create updated storage capacity curves and sedimentation estimates. Comparative data will be collected on lake elevation levels, total and useable storage capacities, surface area, and maximum depth. A control survey of the area will be conducted to support aerial photogrammetric and bathymetric surveys.

Field Survey

A preliminary site survey was conducted on August 16 and 17, 2001, by ECORP subcontractors (WHG and DEA) to gather planning information for the control and bathymetric surveys and assess the feasibility of conducting the bathymetric survey before the summer draw down of the reservoir. The existing water level in the reservoir was determined to be too low to effectively

conduct an accurate bathymetric survey, due the large number of rock outcroppings and islands resulting from unseasonable low water level. These conditions would impede effective vessel operations, resulting in an extended survey schedule and a large number of isolated ponds that would be inaccessible by the survey vessel. Therefore, a control survey was conducted to establish benchmarks to be used by the following field operations. Following completion of the draw down of the reservoir in early September, an aerial topographic survey will be conducted, and a resulting topographic model will be used to plan the summer 2002 survey track lines to be used for the bathymetric analysis. Winter snow pack conditions in the area will be monitored to coordinate field operations with EID Camp 5 engineers to ensure that water levels in the reservoir are optimal for the bathymetric survey.

Because of the high level of spatial variability in lake bottom relief, bathymetric line spacing of 25 feet is recommended to accurately characterize the bathymetric morphology of the reservoir. Because of the shallow nature of the lake, the roughness elements of the lake floor will account for a large percentage of the overall apparent capacity of the reservoir if the bathymetric contours are excessively smoothed as a result of using larger line spacing.

The topographic survey will be conducted using aerial photogrammetric techniques beginning on or about September 17. A field crew will enter the area and place flight crosses at appropriate locations around the lake for the aerial photography. The aerial survey will consist of two to three flight lines. Overflights will be conducted at an altitude >2100 feet above the local terrain. All flight crosses will be removed immediately after completion of flight operations on or about September 21.

Horizontal Control

DEA will establish a main horizontal control network utilizing static mode, differential GPS techniques. Once the main control has been established at the lake, Real Time Kinematic positioning (RTK) shall be based on existing first order control that has been accepted into the National Geodetic Control Network. These data will be based on the North American Datum of 1983 (NAD83), State Plane Coordinate System, California Zone 2.

Vertical Control

The primary horizontal GPS points that are set shall have a third order vertical value assigned to it using GPS techniques. The survey of these points shall meet or exceed third order accuracy standards and shall be tied to existing benchmarks in the project area. The elevations will be based on the National Geodetic Vertical Datum of 1929 (NGVD29) adjustment and calculated to the nearest 0.01 foot.

Monumentation

In order to facilitate reuse of the control in the project area, the GPS control points shall be permanently established by setting a 1¼ inch brass disc, which will be held in with a plastic sleeve, epoxy or other cements. These would be set into the rock with a Bosch battery operated, portable electric drill, which uses internal batteries. Alternatively, we will use a brass screw with a ¾ inch brass washer set in lead. The points necessary for the flight pattern will be determined, but the actual paper targets will not be set out until the time of the aerial survey. Hunter Surveying Inc. will set the targets and remove them after the flight.

Topographic Survey

Target Placement and Removal

A field crew will set the (12" x 10' leg) targets over pre-established control points set by DEA. Target spacing should be approximately 1800' x 3600'. In areas of parallel/adjacent flight lines and within the 30% side lap corridor, there will be certain targets that will be common to multiple photo exposures. These common points will be used to tie the two flightlines together.

The I field crew will place the aerial targets over the provided control points, if the ground conditions at the control point are suitable for a target. If the point is not suitable, I will search for a nearby alternate location and set the aerial target on a secondary un-surveyed control point. After the aerial photography and film processing, an inventory of the flight and aerial targets will be performed. The inventory will observe that flight alignment, photo spacing, flight level/tilt/crab are within standards. This inventory will determine if any targets were destroyed before the photographic recording flight.

Once a photo inventory is complete, I will again mobilize for a reclaim target mission. I will survey secondary target locations and/or photo identified natural targets for inventoried destroyed target during the reclaim mission.

Photogrammetric Survey

The aerial flight consists of two parallel flight lines running in a northwesterly direction. Aerial photography will be performed following placement of aerial targets. Photo coverage will be obtained by American Aerial, located near Ione, California. The time in route to the project, is approximately 20 minutes.

Agfa Pan80 aerial black & white (9"x9") film will be processed within 2 days, reviewed and titled. While assuring proper overlap and coverage, an inventory of the premarks will be performed. I personnel will notify the client of the results concerning destroyed or damaged pre-mark targets.

Aerial photography will be conducted using an Aero-Commander 500 twin engine turbo-charged aircraft. This airplane is equipped with GPS guidance and exposure triggering. The camera is a calibrated Zeiss TOP15, which is an auto-exposure and forward motion-compensation camera. The proposed flight will be at 11,200' above sea level, which is 3,000' above mean terrain. The forward gain of the flight exposures is 1,800' at 60% exposure overlap.

The photo ratio is 1:6,000, which translates to a photo scale of 1"=500'. The enlargement factor from photo scale (1"=500') to mapping scale (1"=100') is 5-times. Two (2) sets of black and white contact prints will be delivered.

Processing and Deliverables

Photogrammetric Map Compilation / Cad Drafting

Through our Galileo Digicart-40 first-order analytical stereo-plotter, data from aerial photographs is digitally collected directly within Autocad.

DATEM DWG/CAPTURE software is a third-party software application running within Autocad. This system allows data recording of breaklines (smooth or sharp) and DTM points, which can be recorded in either stream mode or point-to-point. In stream mode, the frequency of points recorded can be filtered by time, distance or angle of departure from cardinal direction. Masspoints can be recorded individually or by inputting of a determined boundary area and the desired spacing of the points. Irregular pattern area mass point file can also be recorded as input with location of each data point being determined by the operator. A separate masspoint file will be provided in ascii comma-delimited format and in an Excel Spreadsheet.

The raw data (smooth, sharp, structure breaklines, and spot elevations) are processed into DTM/TIN format and 2-foot contours generated from the TIN are interpolated in the Eagle Point's *Advantage System*, which is a third-party package running within Autocad.

Open flatter areas will have spot elevations in a pattern that will provide a 1.5" spacing or less. All trail intersections and other significant areas will carry spot elevations. Grid ticks will be shown representing the NAD 1983 system. Each 5th contour will be shown heavier as an index contour. Spot elevations will be located in normal convention at tops, bottoms, and saddles. Minor editing, labeling, grid ticks and title blocks information is added, and the final mapping product is plotted at 1"=100' on our HP DesignJet 650C. The endeavor is to provide a topographic sheet that clearly, and in an uncluttered manner, depicts the detailed planimetric and topographic features at the lake site.

Additional photogrammetric recording will be obtained from the aerial photographs, to control the outlying areas of the photo for the ortho-photo processing. The diapositives will be scanned for rectifying the ortho image. The raw data are matched to the scanned diapositive images and the image is geographically re-positioned to correct for the elevation displacement recorded in the photographs. The ortho-photo will be a separate TIFF file for superimposing behind the Autocad contour files. To date, aerial targets are tentatively scheduled for the week of September 10th or 17th, 2001, depending on the lake water level.

Bathymetric Survey

DEA will conduct a bathymetric survey of Lake Aloha in accordance with the U.S. Army Corps of Engineers, Class 2 standards. The survey will consist of collecting data along cross sections spaced on 25-foot intervals with additional cross sections taken at significant features (i.e. break points, islands, etc.), into a minimum depth of two feet. The cross sections will generally be run in an east/west direction, with the exception of the arm of the lake on the west side. Cross sections in this area will be collected generally in a north/south direction. The hydrographer will change the azimuth of the cross sections, as needed, in the field to optimize the coverage of the lake. Data will be collected along the cross sections at a rate of 5 times per second and decimated during post-processing. The data will then be sorted to an appropriate distance for the scale of the drawing. It is expected that the aerial survey will provide adequate points of the shoaler areas after the draw down.

Using the old aerial photo and a digital USGS quad map, DEA has approximated 176 line miles needed to complete the survey. This does not include the additional time to transit between lines and between the islands. With the electric motor, speed is a critical issue. We expect to be able to run between one and two miles per hour. To be conservative, we assumed running on average 1.5 mile per hour, and being online surveying 8 hours during a 12 hour day. This time schedule will produce 14.5 days of survey, with 1.5 days of set-up for all the equipment, recovery of horizontal control, installation of an automated tide gauge, and establishment of temporary tide

gauges. Bathymetric survey field operations will be conducted during summer 2002. Exact dates will be determined by the permitting process, weather, and lake water level.

Due to the capricious nature of this type of fieldwork, delays and changes are expected. The bathymetric survey is budgeted for 16 days with additional days to trek in and out of the wilderness area. Additional survey days required due to weather delays or hazards associated with wilderness area wild life or acts of nature will be billed on a time and materials basis.

Bathymetric Mapping

Processing of the bathymetric data will involve editing fliers, applying tidal corrections, thinning the data set and developing a digital model of the lake floor. At this time the aerial data will be combined with the bathymetric data and the differences between the two resolved. A contour map will be produced from the digital terrain model. The data will then be imported in AutoCAD with the aerial photography. It is understood that DEA will provide a paper and digital copy of the contour map, but the paper copy will not include the aerial photo. The aerial photo will be included in the digital file under a separate layer. The scale of the drawings is assumed to be 1"=300'. This may change with the resolution of the aerial survey.

Re-mapping

This will involve taking the data from the surveys of the other three lakes in the re-licensing project and re-mapping them to DEA standards to match the drawings of Lake Aloha. It is understood that DEA will receive already processed and adjusted digital X,Y,Z data from the client in order to complete this task.

Stage-Storage Curves

This will involve importing the X,Y,Z data from the bathymetric and aerial surveys into Terramodel. The points would be used to generate a surface model. From the surface model, acre-feet capacities can be generated. The curve ratings will be delivered to the client in an Excel spreadsheet with a short write up explaining the data.

Sediment Estimates

This will involve taking the historical data of the lake and generating a surface model in Terramodel on a separate layer as the model for the new data. The two surface models will be compared in Terramodel and contours will be generated of the differences. A map will be generated showing those contours. It is assumed that the historical data is only in a paper format. DEA will need sufficient time to digitize the map in order to complete the estimate.

The Bathymetric survey will be performed from a 12 foot inflatable boat using an electric trolling motor. The motor, survey echo sounder, and laptop computer used during the survey will be powered by 12 volt deep cycle marine batteries. This survey will consist of approximately 100 survey lines spaced roughly 100 feet apart. As many as four batteries will be required to operate the vessel and electronics each day. The vessel, camp supplies, batteries and associated survey materials will be brought into the area by pack animal from the head of Upper Echo Lake or Fallen Leaf Lake. Pack services have been arranged through Cascade Stables. The packer has agreed to recharge depleted batteries at his facility. Survey operations will require two people on the vessel with one person remaining in camp to assist with repositioning of shoreline

survey/navigation instruments if necessary. Completion of the bathymetric survey is estimated to be around September 5, 2002.

The topographic survey will be conducted using aerial photogrammetric techniques beginning September 11-17. Following the bathymetric survey EID will begin discharge from Lake Aloha. After sufficient draw down of the lake has been accomplished, a field crew will enter the area and place flight crosses at appropriate locations around the lake for the aerial photography. The aerial survey will consist of two to three flight lines. Overflights will be conducted at an altitude >2100 feet above the local terrain. All flight crosses will be removed immediately after completion of flight operations.

Proposed Options, and Requests for Permits for Mechanical Devices

In an effort to minimize the impact of project mapping operations to the wilderness area, we propose that a gasoline generator be used as the primary power source for the vessel hydrographic data acquisition on the reservoir. This will dramatically reduce the number of batteries required to perform daily survey operations, thereby reducing the number of pack trips into the area. Preliminary estimates of batteries needed for the duration of the survey will require a team of four animals every other day for approximately five round trips of three to four animals each trip. The reduction of the number of batteries required for this replenishment schedule will also result in cost savings to the client. DEA has considerable experience with the use of motor generators as primary sources of power for small boat survey operations. They have current Health and Safety, Environmental Protection, and Accident Prevention Plans. They also have an Activity Hazard Analysis, which has been developed for work with the U.S. Army Corps of Engineers and National Oceanic and Atmospheric Agency on various projects, including areas containing sensitive habitats. We propose to use a *Honda EU1000I* portable generator for the primary power aboard the survey vessel. A *Yamaha*, Model *EF-1000* backup generator will be kept in the camp as a replacement, should the primary generator fail during survey operations. The primary will be used to run all vessel electronics, and recharge on-board batteries. The survey team will employ the generator only long enough to replenish the batteries during daytime survey operations. In addition, the team will perform as much of the survey as possible without active operation of the on-board generator, running only when batteries require recharging. This will 1) minimize the noise impact to the area, and 2) keep the noise impact when the generator is used to the mid-day hours. The above generators were chosen for their efficiency and quiet operation.

The control survey team will need to place permanent markers in the area to serve the bathymetric and airborne survey teams, as well as future client and Forest Service operations in the area. In this effort the survey team would set a 1 ¼ inch brass disc, which will be held in with a plastic sleeve. This would be set into the rock with a *Bosch* battery operated, portable electric drill. The drill would use internal batteries. Alternatively, they would set a brass screw with a ¾ inch brass washer in lead which can be set with a *Star Bar*. This is a manual hammer and chisel operation that requires setting the marker with a lead sleeve. Epoxy or other cements may be used, if required. In the interest of time, the electric drill option is preferred. We feel that the savings in time and cost to the client and the minimal effect on the environment. These hand drills are very quiet compared to their larger pneumatic or electrical counterparts.